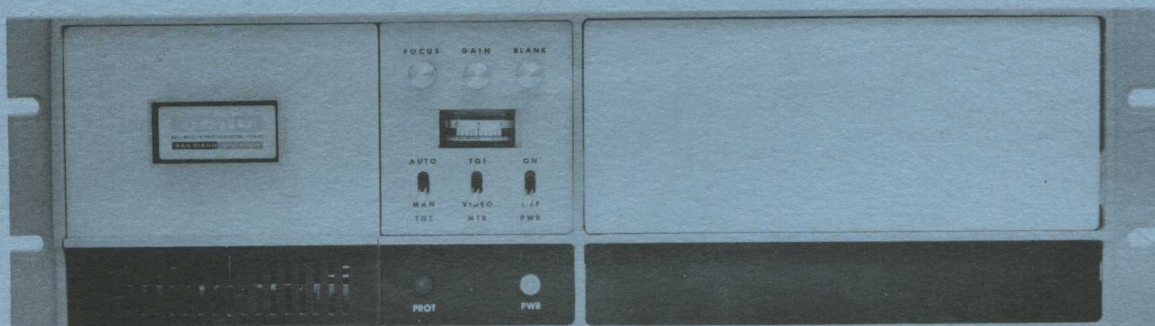
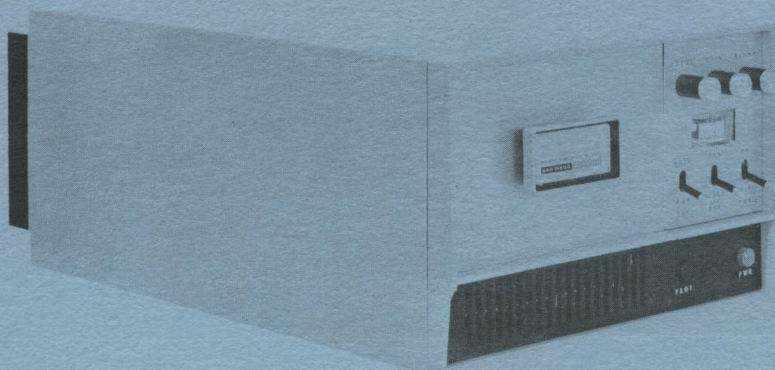




**OPERATING AND MAINTENANCE
INSTRUCTIONS FOR**

HIGH-RESOLUTION MONOCHROME TELEVISION CAMERA CONTROLS 6900/7900/7900B SERIES

**OPERATING AND MAINTENANCE
INSTRUCTIONS FOR
6900/7900/7900B SERIES
CAMERA CONTROLS**

SERIAL NUMBER EFFECTIVITY:

Electrical Assembly:	4-0001 and Higher
Power Supply Assembly:	2-0181 and Higher
Deflection Assembly:	8-0001 and Higher
Deflection Assembly:	9-0001 and Higher
Video Assembly (32 MHz):	1-0001 and Higher
Video Assembly (16 MHz):	2-0001 and Higher
Video Assembly (8 MHz):	3-0001 and Higher
Shading Assembly:	5-0001 and Higher
Shading Assembly:	7-0171 and Higher
Cabinet (Rack):	3-0001 and Higher
Cabinet (Portable):	4-0001 and Higher

Note: Any reference in this manual to 6950 Series Camera Controls also applies to 6900, 7900, and 7900B Series Camera Controls. All pages code numbered 6X-507(A) also are applicable to this manual code numbered 6X-507(B).

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**COHU, INC., ELECTRONICS DIVISION
Box 623, San Diego, California 92112**

INSTRUCTION MANUAL CHANGES

Change No. 1
10-27-71

Code No. 6X-507(A)

HOUSING DIMENSION

Serial Number Effectivity: 4-0001 and ON

Modify housing dimensions for desk-top camera control in Figure 1-1 to reflect *following* additional information:

- a. The width of the housing, front or back, is 8-1/2".
 - b. The depth of the housing from foremost front edge to back surface of rear connector panel is 12-1/2". Add to this dimension 1-1/2" for cable connectors at the rear.
 - c. The height of the housing from outer surface of top plate to outer surface of bottom plate is 5.25". To this dimension add 0.31" for thickness of the four rubber feet that are bolted to the bottom plate near the corners. Each of these four rubber feet has a diameter of 0.5" and is centered on the bottom plate at a point 1.93" from the nearest back or front edge and 1.62" from the nearest side edge.
-

Change No. 2
5-26-72

Serial Number Effectivity: All Units

- a. In Paragraph 2-9 add to note after step g the following: "If automatic iris is not used the automatic light range will be about 8:1."
- b. In Paragraph 2-10 add to step d the following: "Also replace plug-in filter board A1 on video processor board with one having the appropriate new bandwidth (see Table 1 in video board schematic)."
- c. In Figures 3-1 and 3-2 add an additional path for a "black level correction signal" going from shading assembly option to video assembly.
- d. In Figure 3-3 at aperture corrector add an adjustable control labeled FREQ RESPONSE; also add at clamp and dark current compensator an adjustable control labeled SETUP CORRECTION, and move designation "Target Voltage (To Camera)" from +300V terminal to terminal 10.

INSTRUCTION MANUAL CHANGES

Change No. 3
5-26-72

Code No. 6X-507(A)

SHADING BOARD OPTION

Serial Number Effectivity: 5-0006 or Higher

a. In Figure 3-13:

1. Change parameters of waveform at output of Q1 to 2000 μ sec and 4V.
2. Change amplitude of waveform at output of U1-1 to 0.7V.
3. Change amplitude of waveform at output of U1-7 to 1.3V.
4. Move MOD BIAS control from U2 to Q2.
5. Change amplitude at output of U3-7 to 0.8V.
6. Note that amplitude of waveform at output of U3-1 is 0.8V for 1225 line scan rate, 2V for 525 line scan rate, and that amplitude for other scan rates fall within these two extremes.
7. Change last sentence in Paragraph 3-43 to read: "From U2-11 the resultant signal is used to drive Q2, which serves as a driver for the shading modulator on the video processor board."
8. Change last two sentences of Paragraph 3-46 to read: "A dc voltage selected with R17 is used to bias Q2 and thereby control the dc operating point of the shading signal. This dc operating point is set for the proper amount of shading modulator available with the shading controls (± 3 dB or 6 dB total)."
9. In Figure 4-16 change graticule parameters for TP1 to 5 ms/cm; 350 mV/cm, for TP2 to 5 ms/cm; 500 mV/cm and for TP6 to 10 μ s/cm; 1V/cm.

INSTRUCTION MANUAL CHANGES

Change No. 4
5-26-72

Code No. 6X-507(A)

VIDEO PROCESSOR BOARD

Serial Number Effectivity: 1-, 2-, and 3-0076 or Higher

- a. In Paragraph 3-7 add: "R153, R156, a high-frequency peaker at output of the aperture corrector provides additional gain at frequency selected with R156, which is set to correct for black streaking in the video signal."
- b. In Table 4-1 add information for a HI-PEAK control R153 on video processor board. This control adjusts video gain at a selected frequency to compensate for black streaking or smear.
- c. In Paragraph 4-15 modify last part of step j to read: ". . . to eliminate any short white or black fringes that trail or precede these transitions. Adjust HI-PEAK control R153 to eliminate any longer black trails or smears at these same transitions."
- d. In Figure 4-13 change graticule parameters for TP1 waveform to 2 ms/cm; 0.3V/cm, for TP waveform to 5 μ s/cm; 0.3V/cm.

Change No. 5
8-9-72

Code No. 6X-507(A)

POWER SUPPLY BOARD

Serial Number Effectivity: 2-0356 through 2-0405

Diodes CR4 through CR7 (Figure 4-22) have been changed to type 1N5062 (part number 3510094-007) in some units within range of above noted serial numbers.

INSTRUCTION MANUAL CHANGES

Change No. 6
2-5-73

Code No. 6X-507(A)

DEFLECTION BOARD

Serial Number Effectivity: 9-0001 and ON

In Table 4-6 (parts list) change circuit designator R64 (Cohu part number 4045000-226) to R69.

Change No. 7
2-5-73

Code No. 6X-507(A)

DEFLECTION BOARD

Serial Number Effectivity: 9-0136 and ON

- a. In Figure 4-21 (deflection board schematic) and Table 4-6 (deflection board parts list) change R11 to a 0.5 watt, 25 kilohm potentiometer (Cohu part number 5010097-015), and change R14 to a 0.5 watt 500 ohm potentiometer (Cohu part number 5010097-001).

Change No. 8
3-15-73

Code No. 6X-507(A)

VIDEO PROCESSING BOARD

Serial Number Effectivity: 1-0226 and ON

In Table 4-4b (replacement parts) change C22 to 1.0 microfarads, part number 0610136-105.

INSTRUCTION MANUAL CHANGES

Change No. 9 (Sheet 1 of 2)
5-23-73

Code No. 6X-507(A)

CAMERA CONTROL - MAIN ASSEMBLY

Serial Number Effectivity: 4-0156 or Higher

Replace camera control wiring diagram in Figure 4-17 with Figure 1 of this change notice.

Change No. 10
8-1-73

Code No. 6X-507(A)

CAMERA CONTROL - MAIN ASSEMBLY

Serial Number Effectivity: 4-0001 or Higher

a. In Table 4-3 change entries from R1, R2, and R3 to read:

****R1 RESISTOR, CARBON, 1/4W, 5%, 100 KILOHM, part number 4045000-104

*****R1 RESISTOR, CARBON, 1/4W, 5%, 75 OHM, part number 4045000-750

*R1 RESISTOR, VARIABLE, 1/2W, 20%, 10 KILOHM, part number 5010128-103

****R2 RESISTOR, CARBON, 1/4W, 5%, 6.8 KILOHM, part number 4045000-682

*****R2 RESISTOR, CARBON, 1/4W, 5%, 75 OHM, part number 4045000-750

*R2 RESISTOR, VARIABLE, 1/2W, 20%, 2.5 KILOHM, part number 4010128-252

****R3 RESISTOR, CARBON, 1/4W, 5%, 3.9 KILOHM, part number 4045000-392

*R3 RESISTOR, VARIABLE, 1/2W, 20%, 10 KILOHM, part number 5010128-103

b. At end of Table 4-3 add:

****ON TERMINAL BOARD A5

*****AT CONNECTOR J3

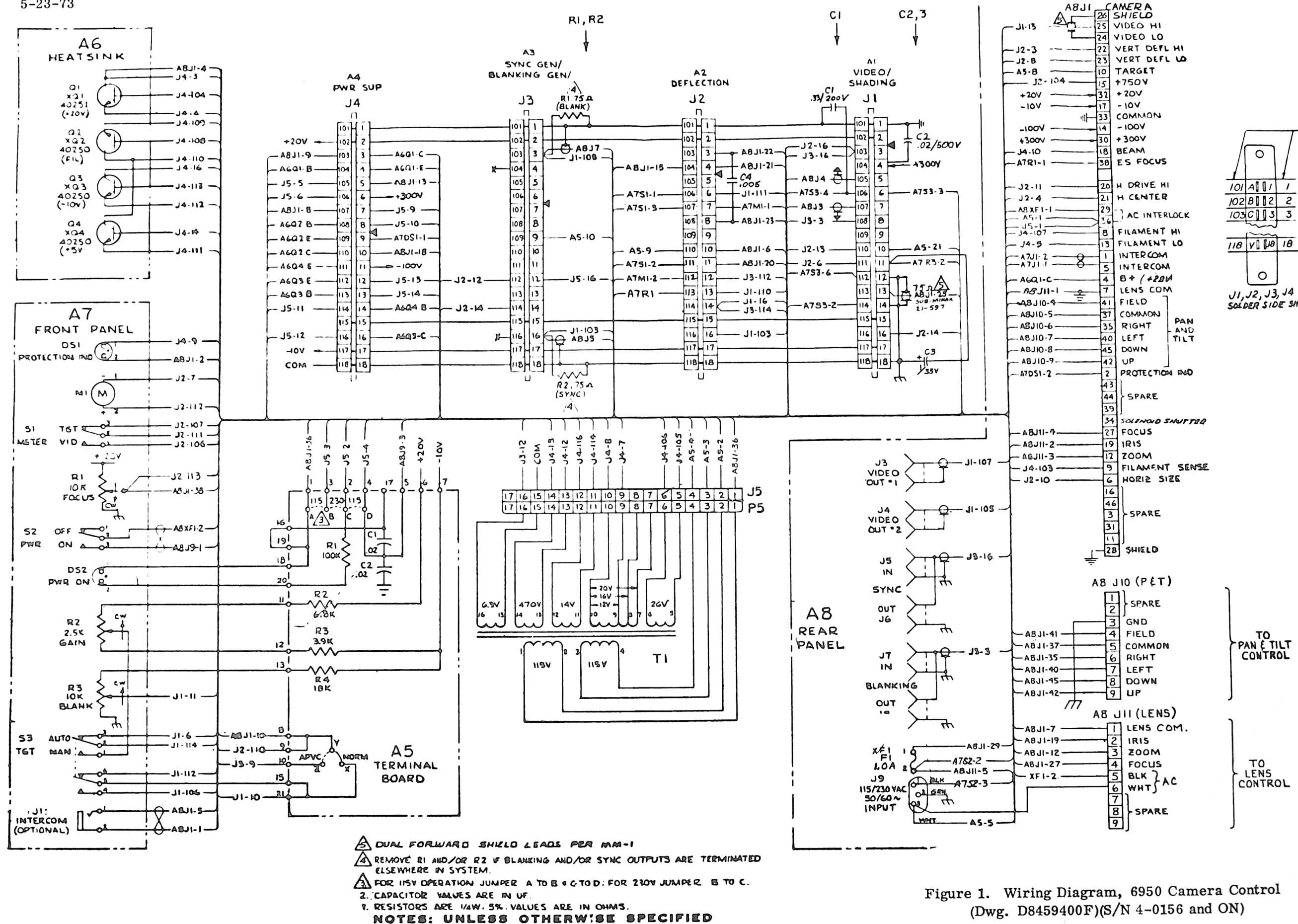


Figure 1. Wiring Diagram, 6950 Camera Control
(Dwg. D8459400F)(S/N 4-0156 and ON)

INSTRUCTION MANUAL CHANGES

Change No. 11
12-21-73

Code No. 6X-507(A)

VIDEO BOARD

Serial Number Effectivity: 1-0026 and ON

- a. In Section IV add a 0.22 microfarad, 100 volt film capacitor (C25, Cohu part number 0610136-224) in series with the bottom end of R51 and ground. Enter same information in Table 4-4b.

Change No. 12
12-21-73

Code No. 6X-507(A)

CAMERA CONTROL WIRING

Serial Number Effectivity: 4-0156 and ON

- a. In Paragraph 1-2 (PHYSICAL DESCRIPTION) delete "plus remote controls for camera accessories such as pan and tilt or motorized focus and iris."
- b. In Figure 2-1 delete ACCESSORY connector and replace with two 12-pin molex connectors labeled, respectively, LENS (J11, Cohu part number 1310288-004) and PAN/TILT (J10, Cohu part number 1310288-003).
- c. In Figure 2-3 (system cable diagram) delete lens and pan/tilt controls from 6950 Camera Control box. Instead, show a 2380 Series Pan/Tilt Control and a 2380 Series Lens Control installed in a separate 2380 Series Rack-Mounting Frame. Also show a cable from the lens control going to the LENS connector at the rear of the 6950 Camera Control and a cable from the pan/tilt control going to the PAN/TILT connector of the 6950 Camera Control.
- d. Delete cable diagram in Figure 2-5.

INSTRUCTION MANUAL CHANGES

Change No. 13
11-6-74

Code No. 6X-507(A)

SECTION V – DEFLECTION BOARD 8459601

Serial Number Effectivity: 6-0036 and ON

In Figure 5-8:

- a. Change U1 to type NE531V (part number 3610168-001)
 - b. Add a 10 picofarad, 500 volt silver mica capacitor (C30, part number 1010006-100) between the bases of Q9 and Q10 and terminal U1-8.
-

Change No. 14
12-3-75

Code No. 6X-507(A)

SECTION IV – VIDEO BOARD 8459101

Serial Number Effectivity: 1-0326 and ON

- a. Change R110 to 2.7 kilohms, part number 4010025-272
 - b. Add to Table 4-4b an R136, a 150 kilohm, $\frac{1}{4}w$, 5% carbon resistor, part number 4010025-154.
-

Change No. 15
12-3-75

Code No. 6X-507(A)

SECTION IV – DEFLECTION BOARD 8455901

Serial Number Effectivity: 9-0341 and ON

In Table 4-6 change C41 to a .05 μ F, 20V, ceramic disc capacitor, part number 0410036-003.

Change No. 16
5-3-78

Code No. 6X-507(A)

CAMERA CONTROL – MAIN ASSEMBLY

Serial Number Effectivity: 4-0001 and ON

- a. In paragraph 2-7, page 2-8 (Power Line Connections) when changing power transformer jumpers from 117 to 230 volt operation, fuse F1 must be changed from a 1.0 amp fuse to a 0.5 amp fuse respectively.
- b. Add to Table 4-3, page 4-61 (Replacement Parts, Camera Control Main Assembly) 1.0 amp, 3AG Slo-blo fuse and 0.5 amp, 3 AG Slo-blo fuse (for 230V ac power input).

INSTRUCTION MANUAL CHANGES

Change No. 17
10-19-79

Code No. 6X-507(A)

SECTION IV – PREVENTIVE MAINTENANCE

In Paragraph 4-15, modify the note following step a to read: "The response of the video amplifier in camera should deviate no more than 0.1 dB per MHz, and video signal at camera output terminal should have a peak-to-peak amplitude of 200 millivolts."

Change No. 18
11-26-79

Code No. 6X-507(B)

Serial Number Effectivity: 4-0746 through 4-0880, and 102902 and ON.

Add to Table 4-3 (Replacement Parts, Camera Control Main Assembly) :

J1	Connector, Electrical Receptacle	1310306-001
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6950 SERIES CAMERA CONTROL

SECTION I

DESCRIPTION

1-1. INTRODUCTION

Cohu 6950 Series Camera Controls are designed to be used with Cohu 6000 Series Television Cameras in broadcast, educational and industrial television systems. In such systems the camera control amplifies and shapes the video signal generated in the camera, houses the controls for operating the camera, and produces most of the dc supply voltages and deflection waveforms needed by the camera to operate.

In most applications the camera control will be located at some convenient point remote from the camera and connected to it with a single multi-conductor cable, the length of which can be up to 2000 feet for an 8 MHz bandwidth system, up to 1000 feet for a 16 MHz bandwidth system and up to 500 feet for a 32 MHz bandwidth system.

The camera control operates with 6000 Series Cameras that have scan rates in the range from 525 to 1225 lines per frame and frame rates of 30 per second standard or 25 per second on special order. The scanning patterns are synchronized from the camera control with sync and blanking pulse waveforms conforming to EIA-RS170 or EIA-RS330 Specifications for 525-line systems or to EIA-RS343 Specifications for systems with the higher line rates. These synchronizing waveforms either are derived with an optional sync generator plug-in unit that fits in the camera control, or they may be supplied from some 75-ohm external source. As another alternative, the circuits in the camera control can be synchronized with externally-applied sync pulses only, in which case the blanking pulses can be generated internally with a plug-in blanking generator option.

1-2. PHYSICAL DESCRIPTION

6950 Series Camera Controls are solid-state electronic devices packaged in either a rack-mounting or desk-top type of enclosure (Figure 1-1). Both of these enclosures are box-shaped and constructed with an alloy of aluminum, and both have hinged front panels that are finished with baked enamel in two colors.

The rack-mounting enclosure can contain two independent camera control modules or one camera control module plus remote controls for camera accessories such as pan and tilt or motorized focus and iris. The desk-top camera control enclosure accommodates one camera control module only (a camera control module is a

slide-in sub chassis on which are installed three standard plug-in etched-circuit boards, seven front-panel operating controls, eight rear-panel cable connectors, a power transformer, a bolted-down etched-circuit terminal board, two indicator lamps and a meter to aid in adjustment of video signal level and target voltage). Test points and additional adjustments for subfunctions are located on the front of the plug-in subassemblies and are accessible through the hinged door panel on the front of the enclosure. One additional position is provided in the camera control sub chassis for either an optional sync generator plug-in circuit board or a blanking generator plug-in circuit board.

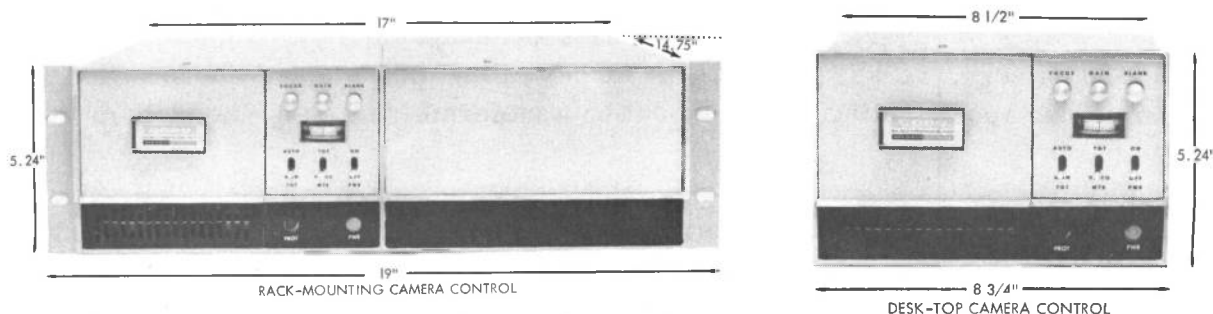
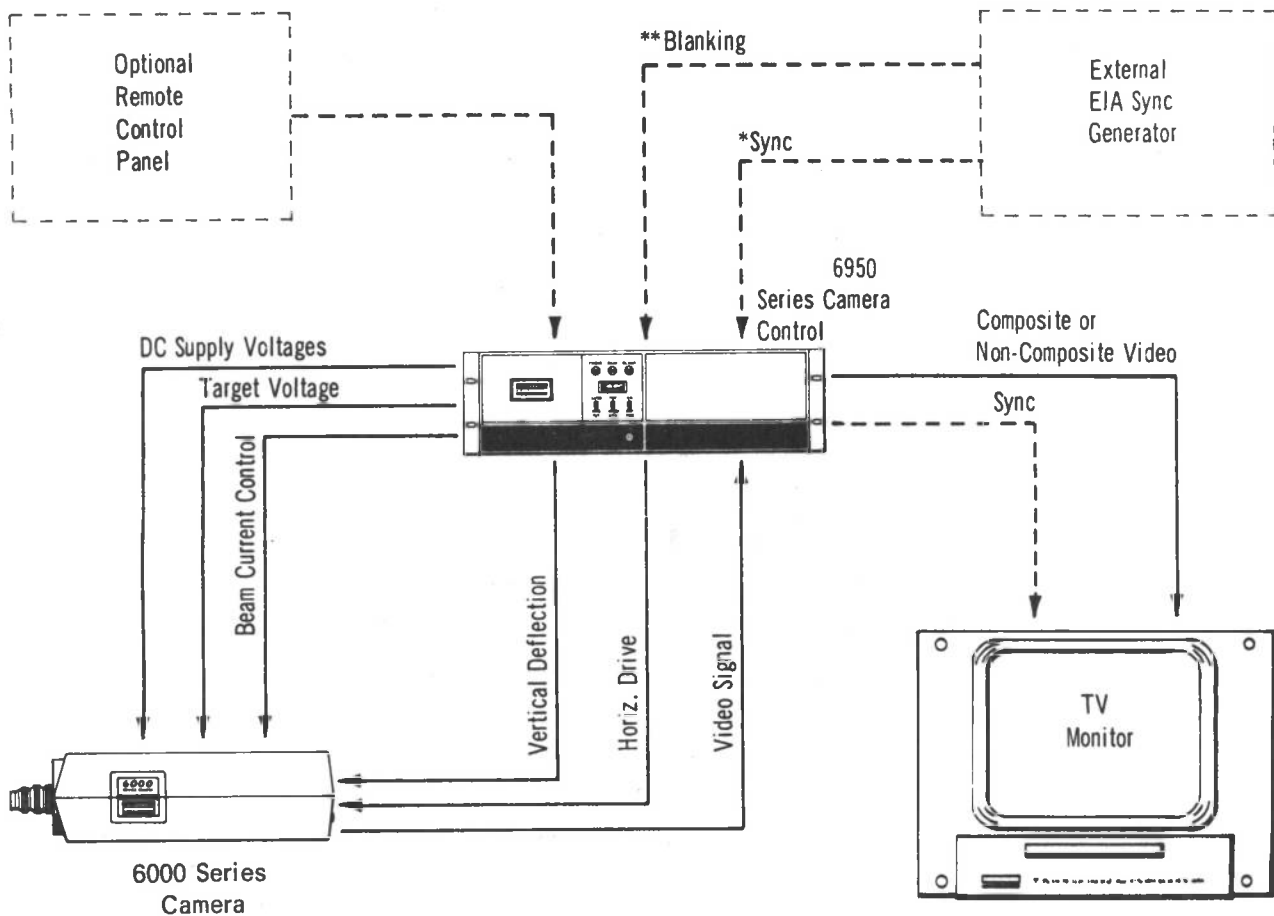


Figure 1-1. 6950 Series Camera Controls

1-3. CAMERA CONTROL FUNCTIONS

The block diagram of a typical TV system where the 6950 Series Camera Control would be used with a 6000 Series TV camera is shown in Figure 1-2. In this system the camera control:

- a. Generates horizontal drive and vertical deflection waveforms, respectively, for a horizontal deflection circuit and a vertical deflection coil winding at the camera;
- b. Produces regulated dc supply voltages for circuits in both the camera and camera control;
- c. Provides operator and automatic controls for video gain and camera sensitivity;
- d. Provides operator controls for focusing of scanning beam on target, adjusting density of scanning beam current and establishing black level of video signal;
- e. Amplifies video signal supplied by camera, compensates for signal transmission losses, and corrects for aperture distortion, gamma distortion and shading aberrations;
- f. Adds synchronizing pulses to video signal;
- g. Supplies the modified video signal on two isolated 75-ohm output lines in composite or non-composite form at voltage levels consistent with the requirements of virtually all TV monitors, video switchers, video tape recorders and video transmitters.



*Sync from an external source is required if camera control does not contain one of the optional 6000 series sync generator plug-in units

**Blanking from an external source is required if camera control does not contain either one of the optional 6000 Series sync generators or the 6000 Series blanking generator plug-in unit

Figure 1-2. Basic Block Diagram of a Typical 6950 Series Television System

1-4. SPECIFICATIONS

Electrical, mechanical and environmental specifications for 6950 Series Camera Controls are listed in Table 1-1.

1-5. ACCESSORIES AND OPTIONS

Accessories and options available for use in the 6950 Camera Control are listed in Table 1-2.

Table 1-1. Specifications for 6950 Series Camera Control
When Operating With 6000 Series Camera

ELECTRICAL

INPUT POWER

117 volts $\pm 10\%$, or 230 volts $\pm 10\%$, 50/60 Hz

POWER CONSUMPTION

60 VA nominal

INPUT SIGNAL REQUIREMENTS

Sync: 2 to 8 volts p-p, as in Figure 1-3, 1-4 or 1-5. (Not required if camera control contains the sync generator option)

Blanking: 2 to 8 volts p-p, as in Figures 1-3, 1-4 or 1-5. (Not required if camera control contains the blanking generator option or the sync generator option)

Video: 0.2 volt p-p, non-composite, white-negative or black-negative. (Supplied by the camera)

VERTICAL SWEEP RATE

60 Hz standard, 50 Hz on special order (sweep rate must be same as power line frequency)

HORIZONTAL SWEEP RATE

(See table below)

LINES/ FRAME	HORIZONTAL SWEEP RATE	
	25 FRAMES/ SEC	30 FRAMES/ SEC
525	13,125 Hz	15,750 Hz
675	16,875 Hz	20,250 Hz
729	18,225 Hz	21,870 Hz
875	21,875 Hz	26,250 Hz
945	23,625 Hz	28,350 Hz
1023	25,575 Hz	30,690 Hz
1125	28,125 Hz	33,750 Hz
1225	30,625 Hz	36,750 Hz

SCANNING PATTERN

525, 675, 729, 875, 945, 1023, 1125 or 1225 lines/frame, 30 frames/sec, 2:1 interlace to EIA-RS170, EIA-RS330 or EIA-RS343 Specifications (Figures 1-3, 1-4 and 1-5); (other patterns are supplied on special order)

HORIZONTAL SCAN FREQUENCY CONTROL

Either crystal-controlled or locked to ac line power if camera control contains the optional plug-in sync generator board. Otherwise, locked to externally applied sync signal

Table 1-1. Specifications for 6950 Series Camera Control
When Operating With 6000 Series Camera (cont.)

SYNC AND BLANKING WAVEFORMS

To EIA-RS170 or EIA-RS330 Specifications (Figures 1-3 and 1-4) for 525-line controls, and to EIA-RS343 Specifications (Figure 1-5) for controls with line rates between 675 and 1225 lines

VIDEO BANDWIDTH

8, 16 or 32 MHz, as requested at time of purchase

VIDEO OUTPUT

White-positive or white-negative, composite or non-composite, on two 75-ohm lines, with greater than 20 dB isolation between lines. Video amplitude is adjustable from 0.7 to 1.5 V, p-p. Sync amplitude in composite video signal is adjustable from 0 to 1 V p-p, and pedestal is adjustable from under 0% to over 50%

GAMMA CORRECTION

Adjustable 0.5 to 1 when video signal from camera is white negative. No gamma correction is provided when video signal from camera is white-positive

FRONT PANEL CONTROLS AND INDICATORS

(See Table 1-3)

MECHANICAL

DIMENSIONS

(See Figure 1-1)

NET WEIGHT

Single Rack-Mount Control:	17 lbs., 8 oz.
Dual Rack-Mount Control:	26 lbs., 8 oz.
Desk-Top Control:	13 lbs., 4 oz.

SHIPPING WEIGHT

Single Rack-Mount Control:	22 lbs.
Dual Rack-Mount Control:	31 lbs., 8 oz.
Desk-Top Control:	13 lbs., 4 oz.

MOUNTING

Standard 19-inch panel rack or desk top

Table 1-1. Specifications for 6950 Series Camera Control
When Operating With 6000 Series Camera (cont.)

CIRCUIT CONSTRUCTION

Solid state, using silicon-type transistor and integrated circuits. Active circuit components, in most cases, are installed on plug-in etched-circuit epoxy boards

ENVIRONMENTAL

AMBIENT TEMPERATURE LIMITS

-20°C to +60°C

AIR PRESSURE LIMITS

To 20,000 feet

VIBRATION LIMITS

±2g, 10-500 Hz

SHOCK LIMITS

15g, all directions

HUMIDITY LIMITS

To 90%

Table 1-2. Options and Accessories

ITEM

Sync Generator (Fixed Scan Rate or Variable Scan Rate)

Blanking Generator

Shading Correction Circuit

Remote Control for Motorized Lens

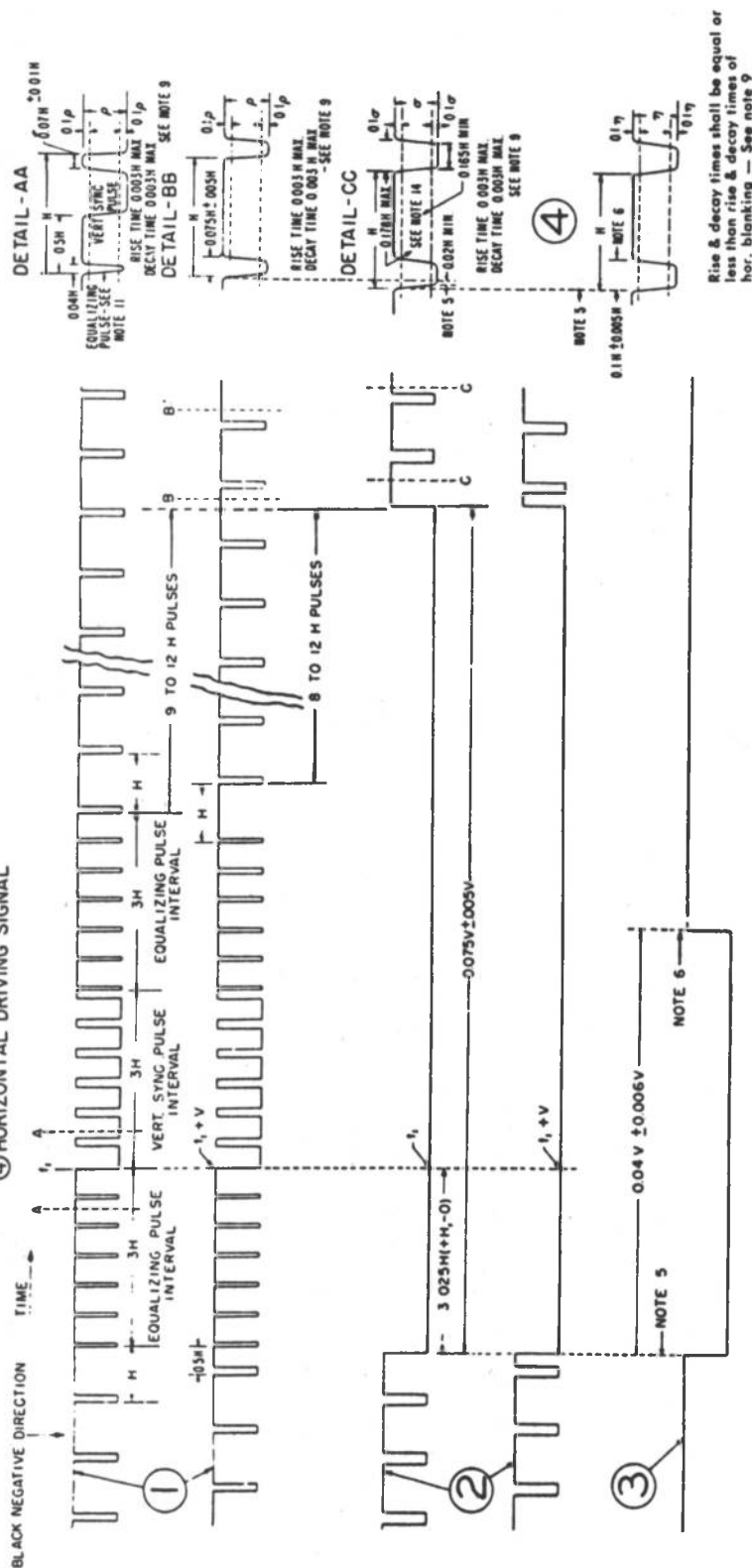
Remote Control for Motorized Pan and Tilt Control
(Fixed or Variable Speed)

Remote Control for Motorized Neutral Density Filter Turret

MONOCHROME TELEVISION
STANDARD SYNC
GENERATOR WAVEFORMS

ALL SIGNAL AMPLITUDES SHALL BE ADJUSTABLE OVER THE RANGE FROM 3.5 TO 4.5 VOLTS ACROSS A LOAD IMPEDANCE OF 75 OHMS $\pm 5\%$. NEGATIVE SIGNAL POLARITY SHALL BE AVAILABLE FOR ALL PULSES. SOURCE IMPEDANCE FOR ALL OUTPUT CIRCUITS SHALL BE 75 OHMS $\pm 10\%$.

① SYNC SIGNAL
② BLANKING SIGNAL
③ VERTICAL DRIVING SIGNAL
④ HORIZONTAL DRIVING SIGNAL



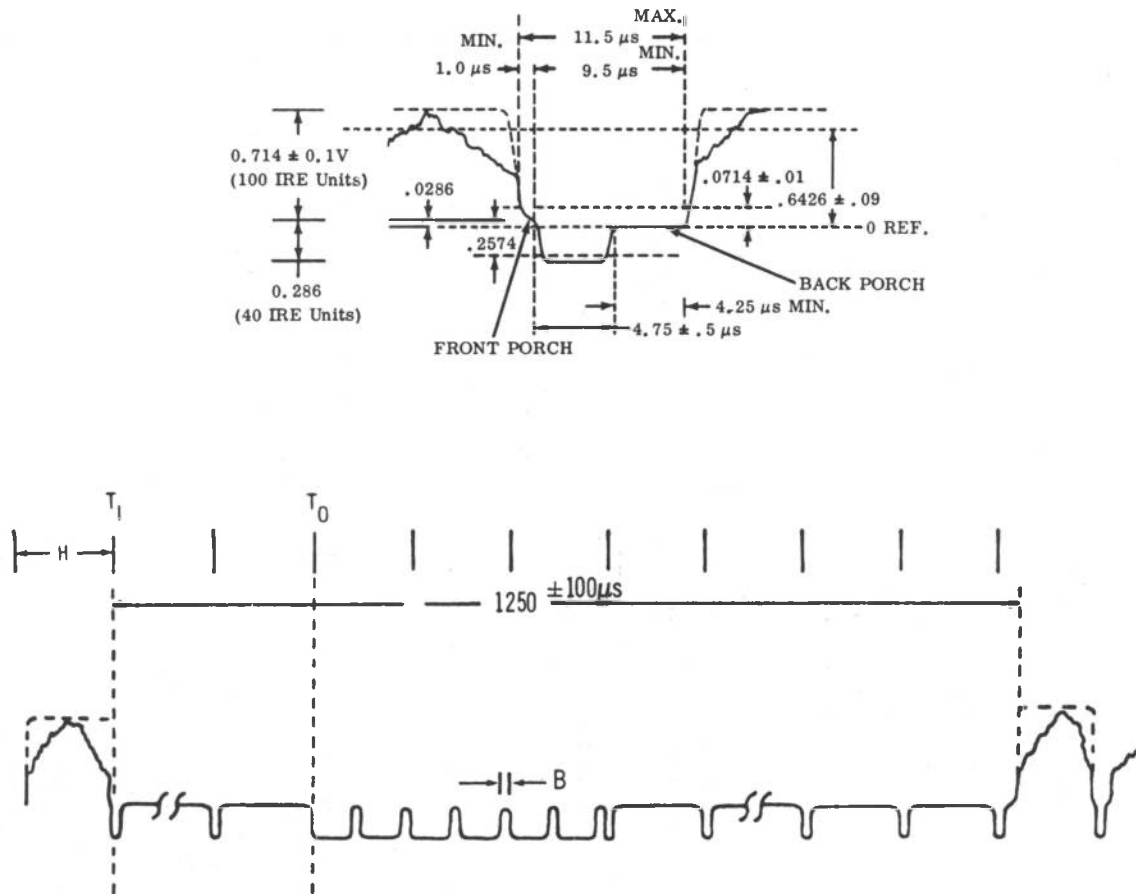
NOTE:

1. H = time from start of one line to start of next line.
2. V = time from start of one field to start of next field.
3. Leading and trailing edges of vertical driving and vertical blanking signals should be complete in less than 0.1H.
4. All tolerances and limits shown in this drawing are permissible only for long time variations.
5. Timing adjustment, if any shall include this condition.
6. The vertical driving pulse duration shall be $0.04V$, $\pm 0.004V$. The horizontal driving pulse duration shall be $0.1H$, $\pm 0.005H$.
7. The time relationship and waveform of the blanking and sync signals shall be such that their addition will result in a standard RETMA signal. The time relationship shall be adjustable in order to satisfy this relationship for the condition where the blanking signal is delayed with respect to the sync signal over the range from 0.0H to 0.05H.

8. The standard RETMA values of frequency and rate of change of frequency for the horizontal components of the sync signal at the output of the picture line amplifier shall also apply to the horizontal components of the output signals from the recommended sync generator.
9. All rise and decay times shall be measured between 0.1 and 0.9 amplitude reference lines.
10. The time of occurrence of the leading edge of any horizontal pulse "N" of any group of twenty horizontal pulses appearing on any of the output signals from a standard sync generator shall not differ from "Nth" by more than 0.0003H where H is the average interval between the leading edges of the pulses as determined by an averaging process carried out over a period of not less than 20 nor more than 100 lines.
11. Equalizing pulse area shall be between 0.45 and 0.5 of the area of a horizontal sync pulse.

12. The overshoot on any of the pulses shall not exceed 5%.
13. The output level of the blanking signal and the sync signal shall not vary more than $\pm 3\%$ under the following conditions:
 - A. The a.c. voltage supplying the sync generator shall be in the range between 110V and 120V and must not vary more than $\pm 5V$ during test.
 - B. A period of 5 hours continuous operation shall be considered adequate for this measurement, after suitable warm-up.
 - C. The room ambient shall be in the range between 20 deg. and 40 deg. C. and shall not change more than 10 deg. C. during this test.
14. Adjustment shall be possible between minimum and maximum limits so that aspect ratio can be set to the normal value.

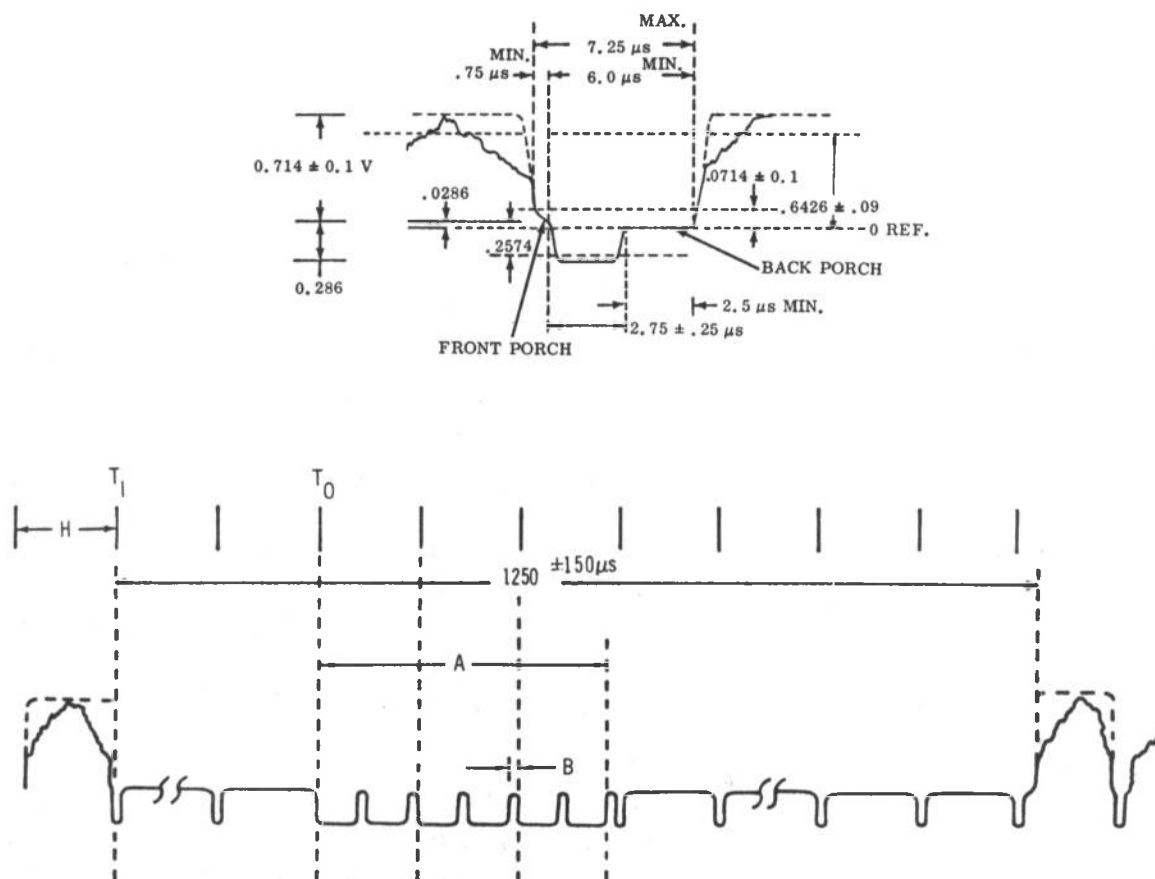
Figure 1-3. EIA RS-170 Specifications



NOTES:

1. $\beta = 0.714 \pm 0.1$ volts (100 IRE Units).
2. $\alpha = 0.286$ (40 IRE Units) nominal.
3. Sync to total signal ratio ($\frac{\alpha}{\beta + \alpha}$) = $28.6 \pm 5\%$
4. Blanking = 7.5 ± 5 IRE Units (2.5% to 12.5% of β).
5. Horizontal Rise Times measured from 10% to 90% amplitudes shall be less than $0.3 \mu/s$.
6. Overshoot on horizontal blanking signal shall not exceed 0.02β at beginning of front porch and 0.05β at end of back porch.
7. Overshoot on sync signal shall not exceed 0.05β
8. T_0 = start of vertical sync pulse.
9. T_1 = start of vertical blanking.
10. $T_1 = T_0 + 0 - 250 \mu/s$.
11. A - vertical sync pulse = $150 \pm 50 \mu/s$ measured between 90% amplitude points.
12. Rise and fall times of vertical blanking and vertical sync pulse, measured from 10% to 90% amplitudes, shall be less than $5 \mu/s$.
13. Tilt on vertical sync pulse shall be less 0.1α .
14. If horizontal information is provided during the vertical sync pulse it must be at 2H rate and as shown in the optional vertical blanking interval waveform.
15. B - vertical serration = $4.5 \pm 0.5 \mu/s$ measured between the 90% amplitude points. Rise time measured from 10% to 90% amplitudes shall be less than $0.3 \mu/s$.
16. If equalizing pulses are used in the vertical blanking interval waveform they shall be 6 in number preceding the vertical sync pulse and be at 2H rate.

Figure 1-4. EIA RS-330 Specifications



NOTES:

1. $\beta = 0.714 \pm 0.1$ volts (100 IRE Units).
2. $\alpha = 0.286$ (40 IRE Units) nominal.
3. Sync to total signal ratio $(\frac{\alpha}{\beta + \alpha}) = (28.6 \pm 5)\%$.
4. Blanking = 7.5 ± 5 IRE Units (2.5% to 12.5% of β).
5. Horizontal Rise times measured from 10% to 90% amplitudes shall be less than $0.1 \mu/s$.
6. Overshoot on horizontal blanking signal shall not exceed 0.02β at beginning of front porch and 0.05β at end of back porch.
7. Overshoot on sync signal shall not exceed 0.05β .
8. T_0 = start of vertical sync pulse.
9. T_1 = start of vertical blanking.
10. $T_1 = T_0 + 250 \mu/s$.
11. A - vertical sync pulse = $125 \pm 50 \mu/s$ measured between 90% amplitude points.
12. Rise and fall times of vertical blanking and vertical sync pulse, measured from 10% to 90% amplitudes, shall be less than $5 \mu/s$.
13. Tilt on vertical sync pulse shall be less than 0.1α .
14. If horizontal information is provided during the vertical sync pulse it must be at $2H$ frequency and as shown in the optional vertical blanking interval waveform.
15. B - vertical serration = $2 \pm 0.5 \mu/s$ measured between the 90% amplitude points. Rise times measured from 10% to 90% amplitudes shall be less than $0.1 \mu/s$.
16. If equalizing pulses are used in the vertical blanking interval waveforms they shall be 6 in number preceding and following the vertical sync pulse, be at $2H$ frequency and $1/2$ the width of H sync pulse.
17. It is recommended that for proper interlace the time duration between the leading edge of vertical sync and the leading edge of horizontal sync be a multiple of $H/2$.

Figure 1-5. EIA RS-343 Specifications

Table 1-3. Front Panel Controls and Indicators

ITEM	FUNCTION
FOCUS control	Adjusts focus of scanning beam on target of image tube at camera
GAIN control	Adjusts light sensitivity of camera when TGT switch is set to MAN (vidicon cameras only)
BLANK control	Adjusts black level of video output signal
TGT switch	AUTO position of switch places light sensitivity of vidicon under automatic control. MAN position enables light sensitivity of vidicon cameras to be adjusted manually with the front panel GAIN control
MTR switch	When switch is set to TGT the meter at front panel indicates the dc voltage on target at camera (vidicon cameras only). When switch is set to VIDEO the meter indicates in millivolts x 0.5 the peak-to-peak amplitude of the video signals less sync at the VIDEO output jacks
PWR switch	Switches system ac power on or off
PROT indicator	Glow when horizontal or vertical deflection failure occurs at camera
PWR indicator	Glow while ac power is turned on
INTERCOM jack	Provides terminal wiring for use with an intercommunications system. The jack is optional equipment and will not be on some camera controls
METER	Indicates approximate dc voltage on image-tube target (vidicon cameras only) while MTR switch is set to TGT, and relative peak-to-peak voltage amplitude x 0.5 of video output signal while switch is set to VIDEO The meter reads 100 volts FS for target voltage and 2 volts FS for video signal

SECTION II

INSTALLATION AND OPERATION

2-1. RECEIVING INSPECTION

The following must be done immediately upon receipt of equipment to determine if damage was incurred in transit: (1) examine equipment for visible damage (2) perform operational testing to ascertain any concealed damage (see Form P-293-5-62-5M enclosed in the packing container).

2-2. WARRANTY

Standard warranty certificate, Form No. S-212 (on inside of back cover), applies to this equipment. Instructions and conditions stated or implied in this manual are not to be interpreted in any manner which would conflict with or modify the meaning or intent of the warranty.

2-3. INSTALLATION

Installation of the camera control consists of: (1) mounting it in the desired location; (2) making the required cable connections to camera, to EIA sync and blanking pulse sources, and to TV monitors, video switcher, tape recorder, etc.; (3) making connection to an ac power source; and (4) making initial adjustments to the system.

2-4. CAMERA CONTROL MOUNTING

Rack-mounting versions of the camera control may be installed in either a standard 19-inch panel rack or recessed console cabinet or on any flat surface. Install desk-top versions of the camera control on any flat surface. Environmental conditions at the installation site must remain within the limits specified in Table 1-1.

2-5. SYSTEM CABLE CONNECTIONS (SINGLE CAMERA CONTROL)

NOTE

Taps for a filament winding on power transformer T1 are set at the factory to allow for losses in camera-to-camera control interconnecting cables up to 250 feet in length. For cable lengths between 250 and 1000 feet move the wire at connector J5 from terminal 9 to terminal 8. For cable lengths between 1000 and 2000 feet move the wire to terminal 7.

Cable connectors for system interfacing are located on a sub panel (Figure 2-1) located at the rear of the camera control housing. Typical cable connections for a basic television system utilizing no accessories outside the camera housing are shown in Figure 2-2. The cable connections to use when a motorized lens and/or pan and tilt unit is involved at the camera are as indicated in Figure 2-3. When making the cable connections:

- a. Attach the cable from the camera (or from a junction box at camera) to the multi-terminal connector labeled CAMERA;
- b. Use the video signal supplied at the BNC connectors labeled VIDEO 1 and VIDEO 2 for driving TV monitors, video switchers, tape recorders or transmitters. For transmission distances up to several hundred feet route the video signals with 75-ohm coaxial cables such as Belden 8281. For greater distances best results will be achieved with RG-11/U coaxial cable and UHF to BNC terminating adapters. Terminate both VIDEO output connectors into 75-ohm loads at signal destinations. If one of the connectors is not used terminate it with the 75-ohm terminating plug on the end of the chain attached to the connector panel. Normally, the video signal is white-positive and composite at both VIDEO connectors, unless otherwise specified when equipment was purchased. The signal at the VIDEO 1 connector can be converted to non-composite by repositioning a plug-in jumper labeled NC-COMP 1 on the video processor board (Figure 4-2) from COMP to NC position. Similarly, convert the signal at the VIDEO 2 connector by moving the jumper labeled NC-COMP 2 from the COMP to the NC position. The polarity of the video signal at both VIDEO output connectors can be converted to white-negative by providing one external contact closure between terminal 39 and the -10 volt bus (terminal 17) at the rear-panel connector labeled CAMERA. However, if negative white video polarity is selected, gamma correction must be set at unity (GAMMA control on video processor board, Figure 2-4, set fully CCW). The peak-to-peak amplitude of the video signal supplied at the two VIDEO output connectors normally is set at one volt (if signal is composite) or 0.7 volt (if signal is non-composite). Video amplitude and black level in signals at both connectors can be adjusted simultaneously as required with the front-panel GAIN and BLANK controls, respectively. If greater video amplitude than that obtainable with the GAIN control is needed, obtain by adjustment of the OUTPUT GAIN control on the video processor board (Figure 2-4). Readjust amplitude of sync, if needed, with the SYNC LEVEL control (Figure 2-4), also located on the video processor board.
- c. If system is to be synchronized with signals from an external source, connect the cables from the external sync and blanking pulse sources to the BNC connectors labeled SYNC IN and BLANK IN. Use good quality 75-ohm coaxial cable such as AC-59 or RG-59B/U for these connections. The SYNC IN and BLANK IN connectors are terminated internally at the con-

- nectors with 75-ohm resistors, and dual connectors are wired in parallel for each type of input signal so the signals can be bridged through to other equipment, if desired. If either input signal is looped-through and used elsewhere, clip the terminating resistor at the connector and terminate the cable carrying the signal into a 75-ohm load at its final destination. If either the optional sync generator or the optional blanking generator is used in the camera control to produce the required sync and/or blanking signals, these same signals will be available on 75-ohm lines at the SYNC IN and BLANK IN connectors and they may be used at the same time to synchronize several other camera chains. If they are used, clip the terminating 75-ohm resistors at the connectors and terminate the cables that are used to conduct the signals into 75-ohm loads at the final unit in the chain.
- d. If the camera control enclosure has remote control modules in it for camera accessories (motorized lens, pan and tilt or lens and neutral-density filter turret), use the cable supplied with the remote controls or make one up in accordance with Figure 2-5 and connect it between the REMOTE receptacle (Figure 2-1) and the receptacle on each remote control module.

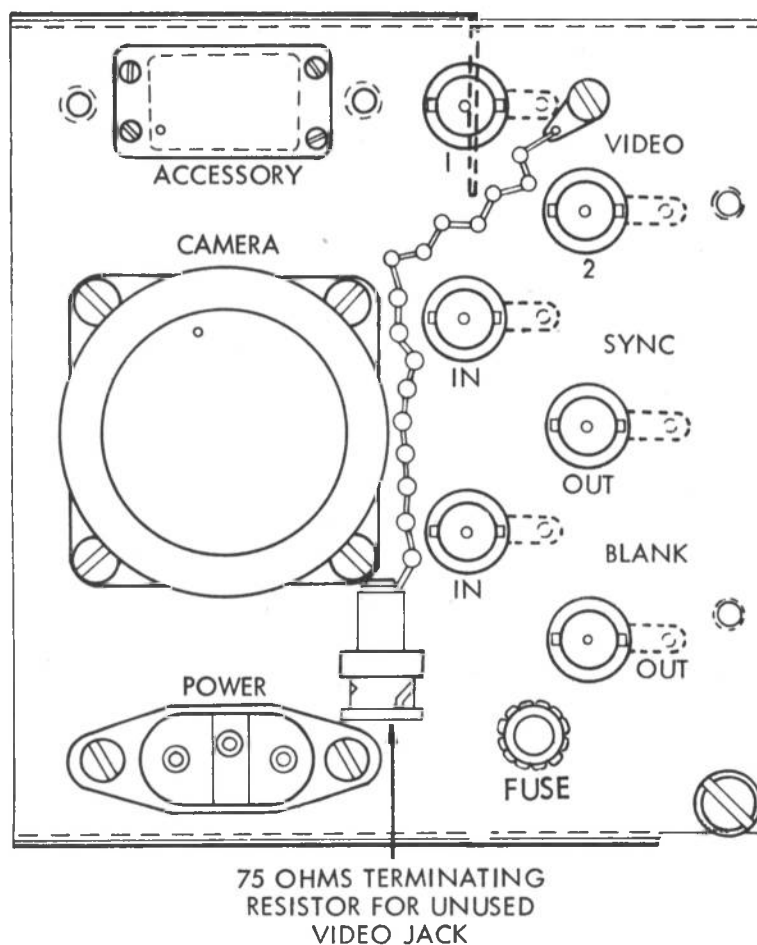


Figure 2-1. Connector Panel at Rear of Camera Control

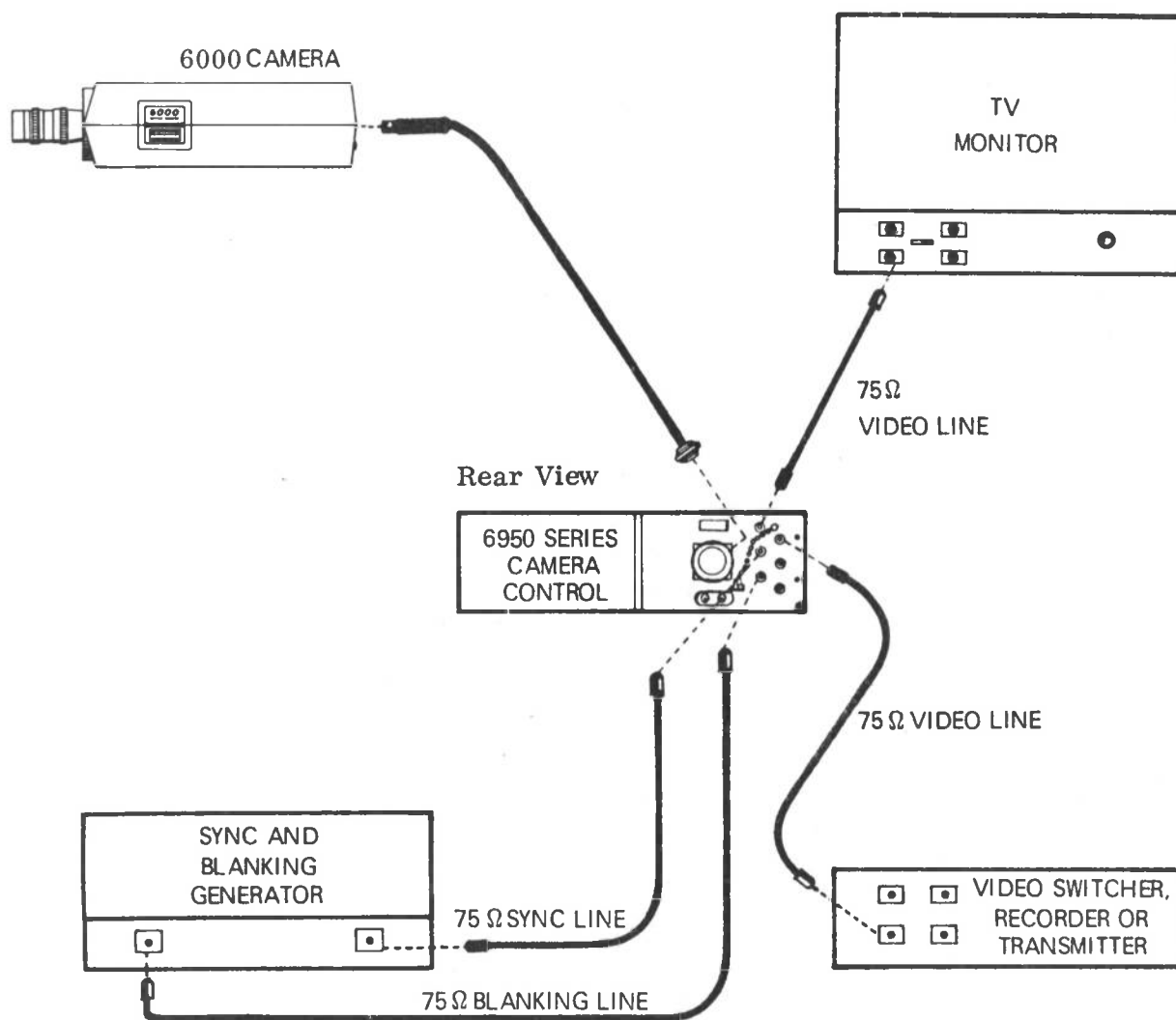


Figure 2-2. Typical Cable Connections for TV Systems with no Accessories External to Camera Housing

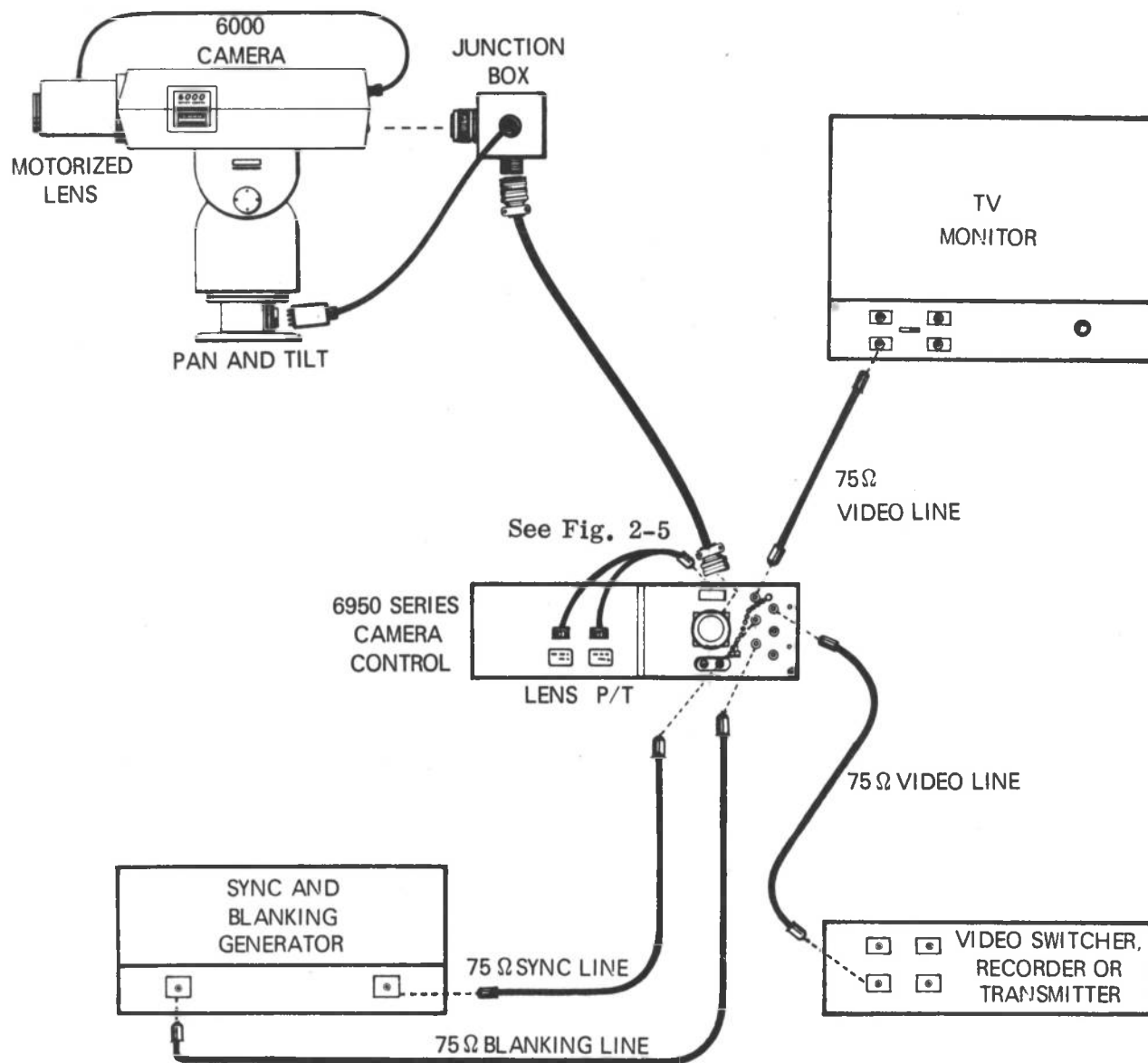


Figure 2-3. Typical Cable Connections for TV System with Accessories External to Camera Housing

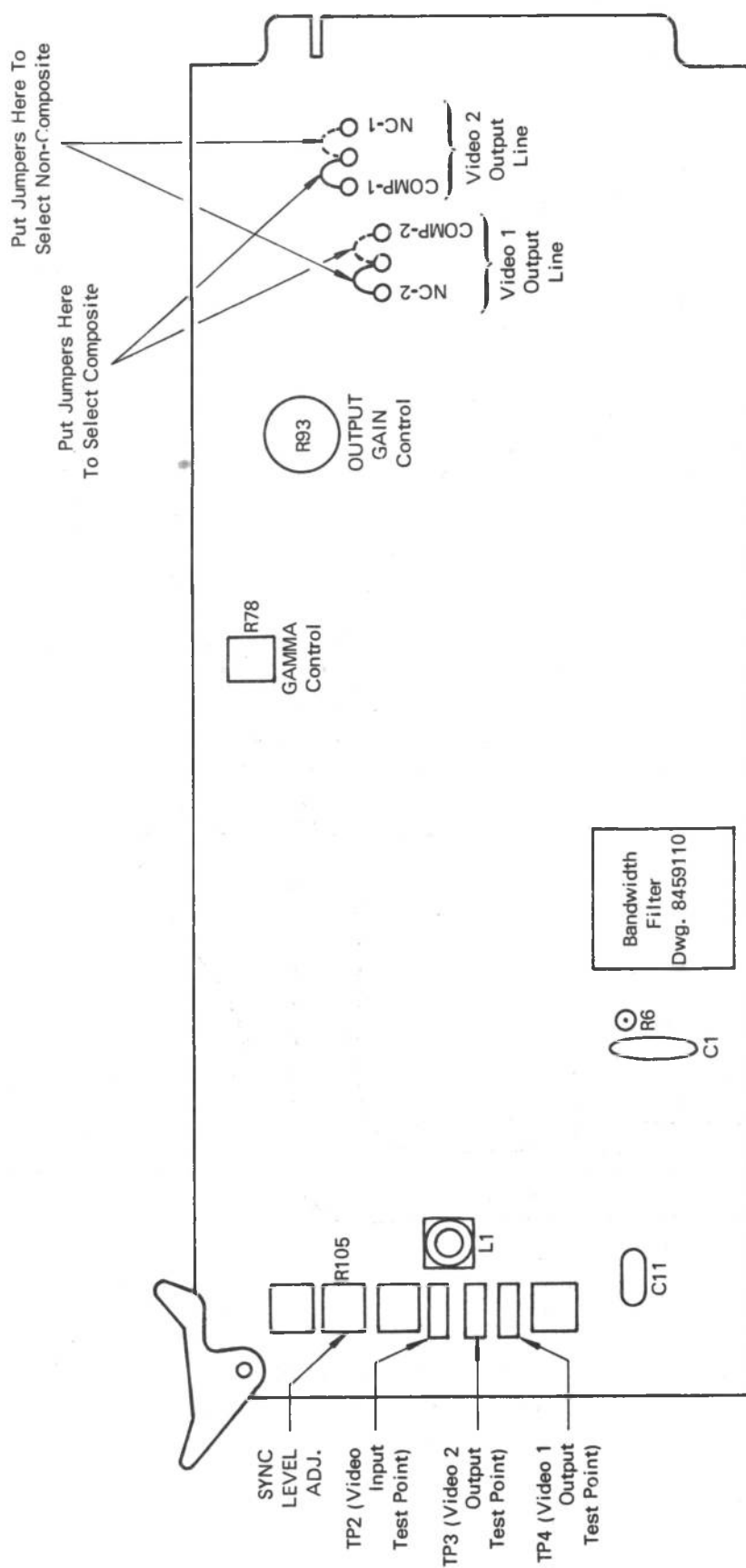


Figure 2-4. Video Processor Board

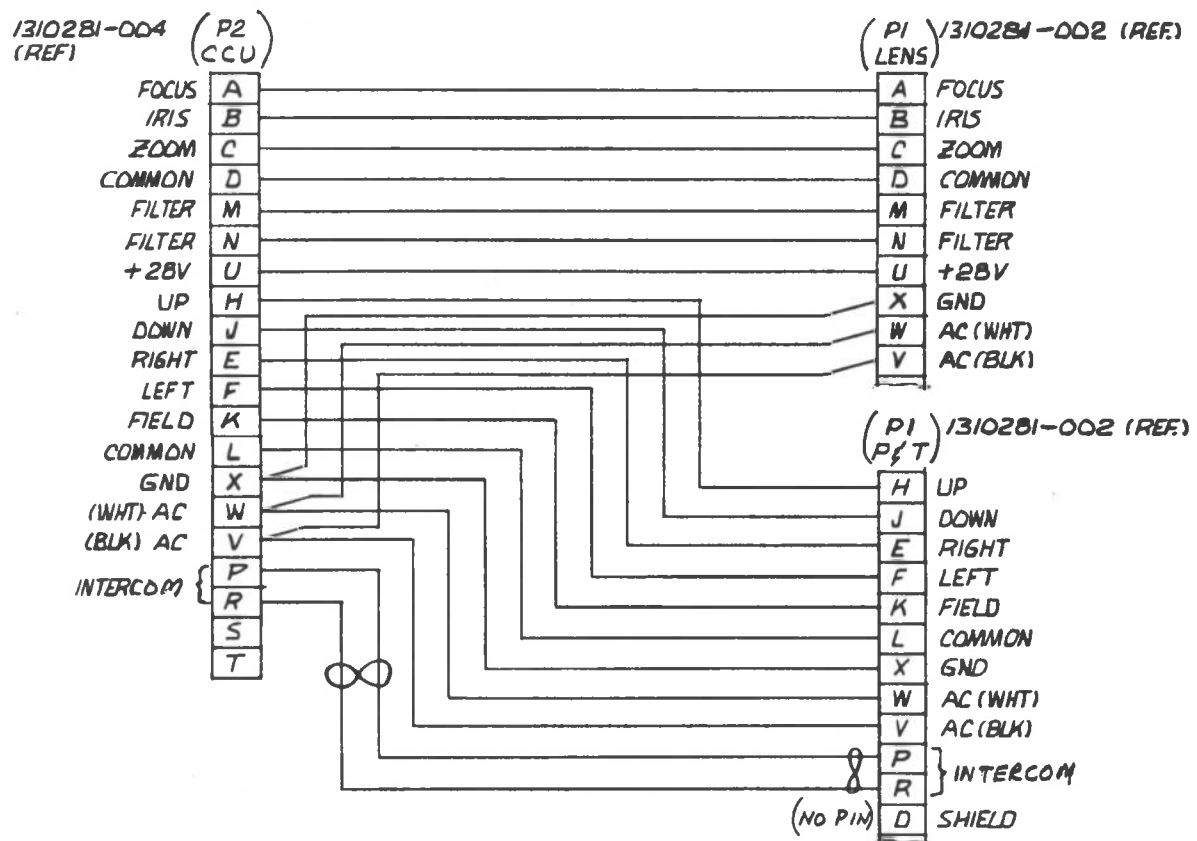


Figure 2-5. Interconnecting Cable Diagram, Remote Control Modules to Camera Control Module

2-6. SYSTEM CABLE CONNECTIONS (DUAL CAMERA CONTROL)

In dual 6950 Camera Controls where each of the two camera control modules in the enclosure is to be operated in a system with its own sync pulse source the cable connections for each module are the same as those outlined for a single camera control in Paragraph 2-5. If both camera control modules are to be synchronized with one plug-in sync generator the instructions in Paragraph 2-5 are still valid with the following exceptions:

- a. Plug the sync generator into either of the two camera control modules at the assigned location;
- b. Remove or disconnect the internally-installed 75-ohm terminating resistor at the SYNC OUT and BLANK OUT connectors (Figure 2-1) located on the rear of the module in which the sync generator is installed;
- c. Using 75-ohm coaxial cables terminated at both ends with BNC connectors, jumper the SYNC OUT and BLANK OUT connectors on the camera control module where the sync generator is installed to the SYNC IN and BLANK IN connectors, respectively, on the other camera control module.

NOTE

If more than two television systems are to be synchronized with this same sync generator plug-in unit, also remove the internally-installed 75-ohm terminating resistors at the SYNC OUT and BLANK OUT connectors on the rear of camera control module not containing the sync generator. Then attach the sync and blanking cables for the other systems to these same SYNC OUT and BLANK OUT connectors, and terminate the cables into 75-ohm loads at the last system in the chain.

2-7. POWER LINE CONNECTIONS

Each camera control module in a 6950 Series Camera Control enclosure requires 117 volts $\pm 10\%$ or 230 volts $\pm 10\%$, 50 or 60 Hz for operation. The ac power is applied at the rear of the module to a receptacle labeled POWER (Figure 2-1), using a detachable power cord terminated on both ends with a three-terminal grounding-type plug. The power consumption is 60VA. The line voltage to use is selected with jumpers located on a terminal board (Figure 2-6) located adjacent to the power transformer. Before ac power can be applied a bracket installed to protect the POWER receptacle in shipment must be removed. This bracket is secured with one screw and can be removed by taking out the screw, which is located at the bottom of the enclosure. It is not necessary to reinstall the screw unless the bracket is to be put back on so the camera control can be re-shipped.

2-8. OPERATING PROCEDURE FOR SYSTEM USING CAMERA WITH VIDICON TUBE

After the camera control has been installed in a system as instructed in Paragraphs 2-4 through 2-7:

NOTE

Under average operating conditions the system is designed to provide at the output jack a one volt p-p composite video signal or a 700 millivolt p-p non-composite video signal

- a. Aim camera at the scene to be televised, and set focus ring on lens so it is as correct as nearly as can be approximated for the distance separating the camera from the scene;
- b. Select an aperture setting for the lens that is appropriate for the illumination on the scene (indoor scenes with average illumination usually will require an aperture setting in the range from $f/1.9$ to $f/3.5$, while outdoor scenes in daylight require a setting in the range from $f/5.6$ to $f/22$);
- c. At the camera control front panel set TGT switch to MAN, MTR switch to TGT, BLANK and FOCUS controls to midpoint, and PWR switch to ON;
- d. Adjust front-panel GAIN control for a target voltage reading at front-panel meter of 20 volts (the meter is calibrated in increments of 10 volts from 0 to 100 volts);
- e. Adjust BEAM control on power supply board (Figure 2-7) until the picture wipes in evenly over entire monitor raster;

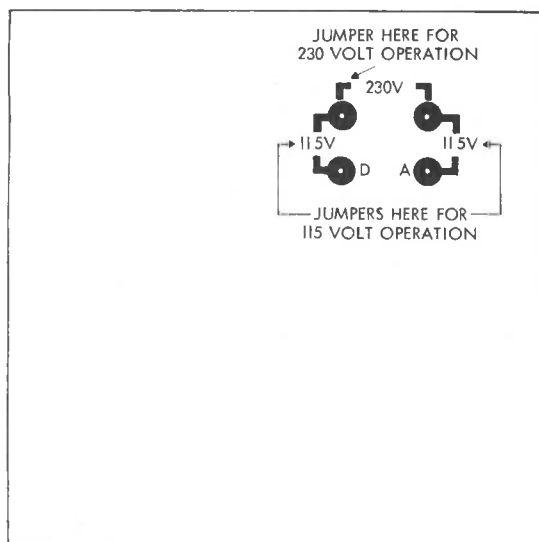


Figure 2-6. A5 Terminal Board

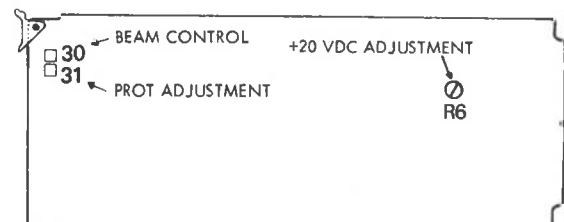


Figure 2-7. Power Supply Board Adjustments

- f. Adjust BLANK and FOCUS controls for best picture;
- g. Repeat BEAM, BLANK and FOCUS control adjustments in steps e and f to obtain best picture possible;
- h. Set TGT switch to AUTO;
- i. If scene lighting conditions are extreme, set TGT switch to MAN and adjust for best picture with GAIN control.

2-9. OPERATING PROCEDURE FOR SYSTEM USING CAMERA WITH A LEAD OXIDE IMAGE TUBE

After the camera control has been installed in a system as instructed in Paragraphs 2-4 through 2-7:

- a. Aim camera at the scene to be televised, and set focus ring on lens so it is correct as nearly as can be approximated for the distance separating the camera from the scene;
- b. Select an aperture setting for the lens that is appropriate for the illumination on the scene (indoor scenes with average illumination usually will require an aperture setting in the range from f/5.6 and f/11, while outdoor scenes in daylight will require a setting between f/16 and f/32;
- c. At the camera control front panel set TGT switch to MAN, BLANK and FOCUS controls to midpoint, and PWR switch to ON;
- d. Adjust BEAM control on power supply board (Figure 2-7) until picture wipes in evenly over entire monitor raster;
- e. Adjust BLANK and FOCUS controls for best picture;
- f. Repeat BEAM, BLANK and FOCUS control adjustments in steps e and f to obtain best picture possible;
- g. Adjust aperture on lens as needed to maintain desired picture brightness level and contrast with changes in scene illumination. (Under average operating conditions the system is adjusted at the factory to provide at the output jack a one volt p-p composite video signal or a 700 millivolt non-composite video signal).

NOTE

In some 6000 Series cameras with lead-oxide image tubes the camera sensitivity to light will be adjusted automatically if TGT switch on camera control front panel is set to AUTO, or it can be adjusted with the front panel GAIN control if TGT switch is set to MAN.

2-10. PROCEDURE FOR CHANGING HORIZONTAL SCAN RATE

To change the horizontal scan rate of a 6950 Series Camera Control:

- a. First be sure that the 6000 Series Camera being used with the camera control has been designed originally or modified to operate at the new scan rate. (See procedure for modifying in camera instruction manual);
- b. If the optional Cohu variable scan rate sync generator is being used in the camera control to generate the required sync and blanking pulses, ensure that it has been designed to operate at the new scan rate; if not, make the modifications outlined in the sync generator instruction manual;
- c. Refer to camera instruction manual under Resolution Specifications and determine what video bandwidth is required to achieve desired horizontal resolution with new scan rate; then refer to installation procedure in same instruction manual and ascertain if camera-to-camera control interconnecting cable is the proper one for video bandwidth selected in step c; if not, replace with the cable specified;
- d. Refer to video schematic in Section IV; from Table 1 in the schematic determine what the inductance of L1 and capacitance of C11 on the video processor board (Figure 2-4) should be for the video bandwidth selected in step c; replace the components with ones having the values specified; using Table II in video schematic, ascertain if C1 and R6 on the video processor board have the correct values for the video bandwidth and camera-to-camera control interconnecting cable selected in step c; if not, change to ones having values corresponding to those specified;
- e. With the exception of those for the low-voltage supplies, perform the service adjustments outlined in Section IV.

SECTION III

CIRCUIT DESCRIPTION

3-1. INTRODUCTION

In most cases the active components in standard 6950 Series Camera Controls are located on the following plug-in circuit board assemblies:

- a. Video
- b. Deflection
- c. Power Supply

As options, the camera control also may contain a shading correction circuit plug-in board assembly and/or one of the following plug-in circuit board assemblies:

- a. Sync generator
- b. Blanking generator

Depending on which, if any, of the options are included, the basic functional diagram of the camera control is either Figure 3-1 or 3-2. The circuit descriptions in the following paragraphs will be keyed to these diagrams.

3-2. VIDEO ASSEMBLY CIRCUIT DESCRIPTION (Dwg. 8459100)

The video processor (see video schematic in Section IV) contains a video processor and a +10 volt regulator. These are discussed in Paragraphs 3-3 through 3-17.

3-3. VIDEO PROCESSOR

The video processor amplifies the video signal received from the camera, provides aperture and gamma corrections, compensates for cable transmission losses, re-establishes a black reference level and adds sync and blanking to the signal. For descriptive purposes the video processor circuits can be broken down into the sections indicated in Figure 3-3.

3-4. BANDPASS FILTER/CABLE COMPENSATOR. The video signal from the camera is received on the video board at terminal 13 where it is white-negative in polarity and has a nominal peak-to-peak amplitude of 200 millivolts. From terminal 13 the signal is transferred through a low-pass filter and a cable compensation network. The low-pass filter (see filter schematic in Section IV) is an LC network with a response that is flat within ± 0.5 dB up to the top frequency of the bandwidth specified for the system (8, 16 or 32 MHz) and 3 dB down at the top frequency. Above this cutoff frequency the filter roll-off characteristic is 100 dB per decade. All of the components in the filter are installed on a small etched-circuit board that plugs into three terminals on the video board. Component values in the filter vary with system bandwidth, as indicated in Table II in the video schematic.

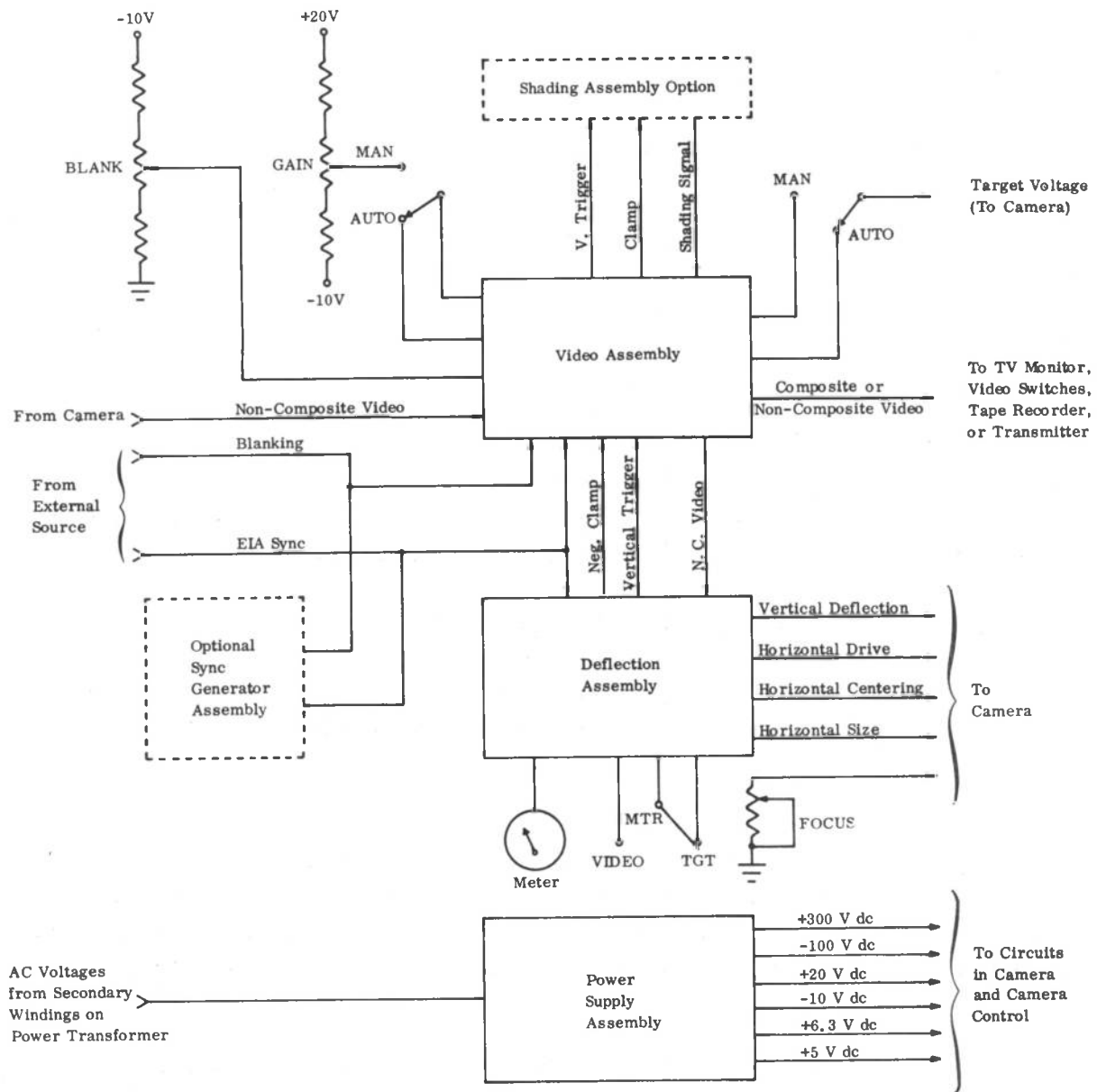


Figure 3-1. Basic Functional Diagram of Camera Control with or Without Sync Generator Option or Shading Circuit Option

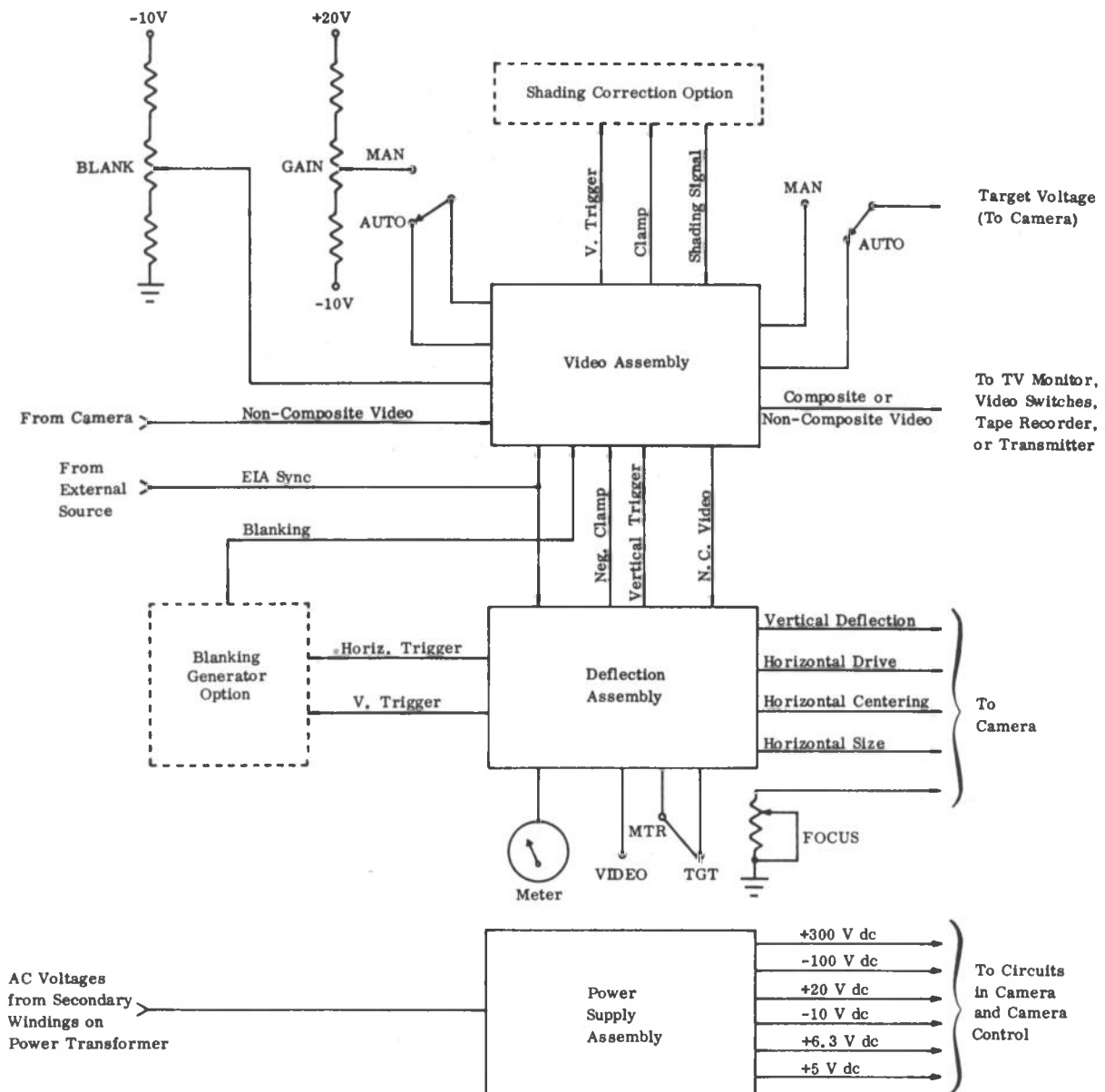


Figure 3-2. Basic Functional Diagram of Camera Control with Blanking Generator Option and with or Without Shading Circuit Option

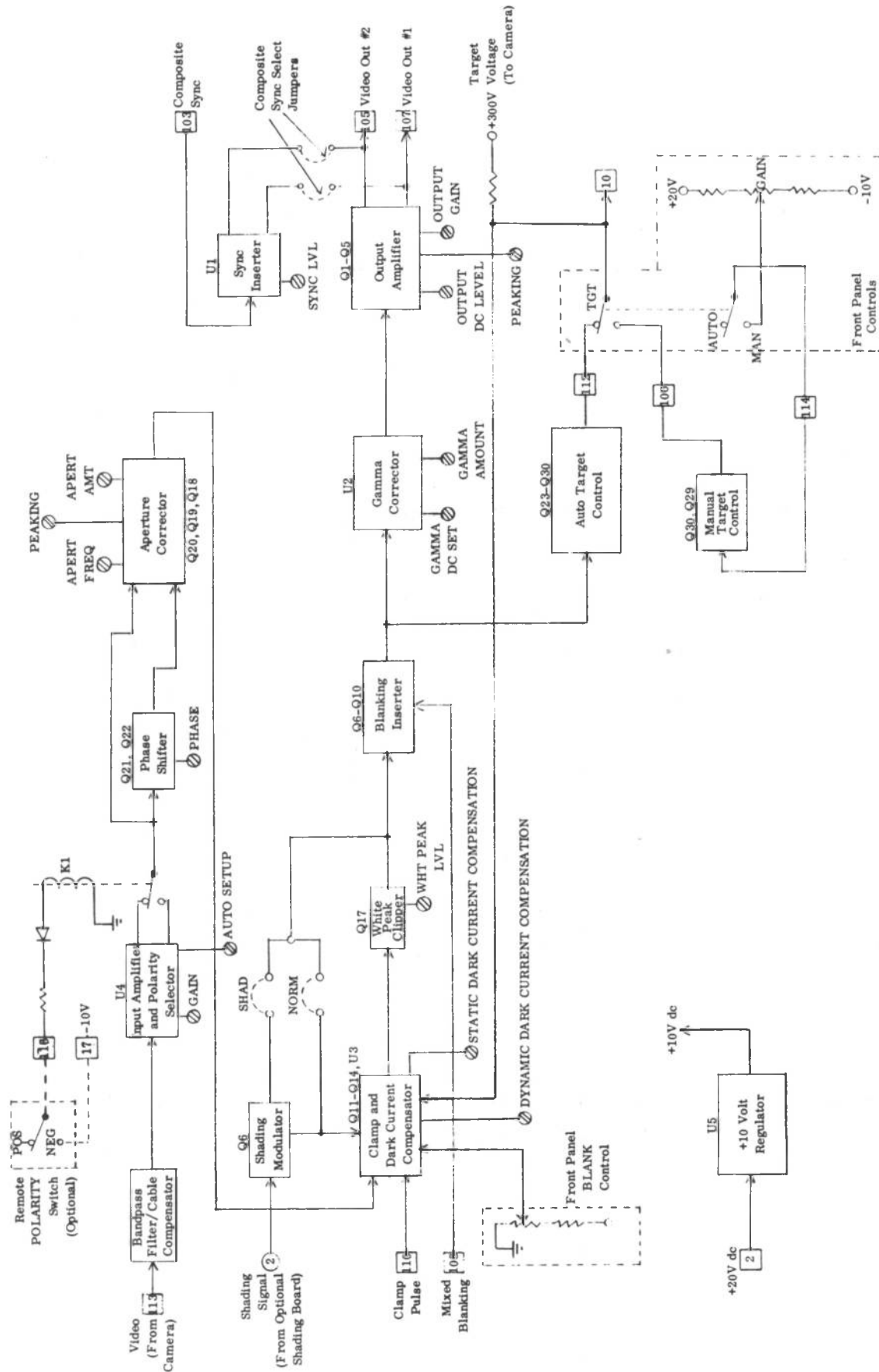


Figure 3-3. Block Diagram of Video Board in Camera Control

The cable compensator, an RC network formed with C1, R2, R6, R8 and R10, equalizes the video signal for high-frequency roll-off resulting from distributed capacities in the camera-to-camera control interconnecting cable and input wiring. Component values in the network vary with system bandwidth and cable length, as indicated in Table II in the video schematic.

3-5. INPUT AMPLIFIER AND POLARITY SELECTOR. The video signal appearing at the output of the cable compensator (Paragraph 3-4) is amplified by U4 to bring it up to a level of about one volt peak to peak. U4 is an integrated circuit differential amplifier with a gain of approximately five, which is set with GAIN control R3. After the signal is amplified by U4 it is supplied white-negative at terminal U4-8 and white-positive at U4-7. Only one of these signals is selected with relay K1 for further processing, the choice depending on what video polarity is desired at the camera control VIDEO output terminals. If the wanted polarity is white-positive then K1 remains de-energized. Otherwise, the relay must be energized with -10 volts dc applied via R5 and CR3 with an external contact closure, which selects the signal at terminal U4-7.

3-6. PHASE SHIFTER. The video signal selected with polarity relay K1 drives a 180° phase shifter formed with transistor stages Q21 and Q22. The first stage, Q21, operates as a phase splitter with a half-lattice network (C11, R22) connected between its two opposing polarity outputs. The second stage (Q22) functions as a buffer for the lattice network, in which the high frequencies in the video signal are shifted in phase by certain amounts within the range from 0° to 180°, as determined by the setting of R22. This phase shift equalizes delay to improve video transient response.

3-7. APERTURE CORRECTOR. The aperture corrector (Q20, Q19, Q18, Q16) enhances camera performance by sharpening the edges of picture details that have been softened by the finite spot size of the scanning beam where it strikes the target. The circuit is driven at the base of Q20 with the video signal from polarity-select relay K1 and at the base of Q18 with the video signal that was altered in phase at the phase shifter (Paragraph 3-6). Q20, a tuned amplifier, has a collector load that is adjusted with L1 to resonate with distributed capacities at 30 MHz in 32 MHz bandwidth systems, 14 MHz in 16 MHz bandwidth systems, or 6 MHz in 8 MHz bandwidth systems. The signal at the output of Q20 therefore contains only the higher-frequency components of the original video signal. At Q19, Q18, a summing amplifier, these high-frequency components are added via Q19 to the phase-shifted video signal that is added via Q18 to provide across a common frequency-compensated load (R33, L2) a video signal with controlled amounts of higher frequency phase correction and peaking. In effect, this speeds up the transient response of the system, thereby improving the resolution of fine details in the picture. The amount of high-frequency peaking provided is determined by the setting of APERTURE control R28, a signal attenuator. The modified video signal across collector load R33, L2 drives Q16, a buffer amplifier that, in turn, drives the dark current and clamp circuit described in the next paragraph.

3-8. CLAMP AND DARK CURRENT COMPENSATOR. The principal components in this circuit are transistors Q11 through Q15, integrated circuit U3 and varistor VR1. Transistors Q12 and Q11, operating together as a buffer amplifier with a high input impedance, couple the aperture-corrected video signal to the white-peak clipper described in Paragraph 3-9. At the base of Q12 the video signal has an amplitude of about two volts peak-to-peak. During horizontal retrace a dc component is added to this signal when clamp transistor Q15 is driven to saturation via amplifier Q13, Q14 with a negative-going two-microsecond clamp pulse received at board terminal 110. This added dc component is provided by U3, a summing amplifier with two inputs. One of the inputs, via R51, is a dc black level setup signal selected with the BLANK control on the front panel of the camera control housing. Added to or subtracted from this setup signal is a dc correction signal derived from the target voltage with a network consisting of R15, RV1, R13, R12, C7. This network senses changes in target voltage and, due to the negative coefficient of varistor VR1, develops a dc potential that exactly compensates for changes in dark current at the target with changes in target voltage. The amount of correction provided by VR1 to the input of U3 is adjustable over a narrow trim range with R13, which is damped for transients with R12, C7. If video polarity at the camera control VIDEO output jacks is to be white-negative the dark-current compensating network is disconnected by energized polarity relay K1. If white-negative polarity is selected, the setup level is automatically increased 100% to maintain the proper black reference level. This is done by network R14 and R150, which sums a negative dc voltage into U3.

3-9. WHITE PEAK CLIPPER. On white peaks of the video signal, at a level set with R57, transistor Q17 conducts and clips the signal. This clipping starts when the amplitude of the signal reaches about two volts and has the effect of reducing brightness on highlights so picture details can show up more clearly. Within the range of R57 the clipping level can be adjusted down to 200 millivolts.

3-10. SHADING MODULATOR. When the optional shading board is a part of the system the shading modulator (Q6) compensates for non scene-dependent signals generated as a result of imperfections in optics and the surface of the vidicon target in the camera. The remedial technique is based on the fact that such signals can be equalized by superimposing combinations of sawtooth and parabolic waveforms on the video signal at line and field rates. When the shading board is not part of the system the modulator is disconnected from the video circuits by moving a jumper at R61-R63.

Q6 is driven at its gate terminal with the composite shading signal applied through R59 via pin #2 from the shading board. Variations in amplitude of this signal cause corresponding variations in source-to-drain resistance in the transistor. These resistance variations change the ac impedance to ground as seen by the video signal. This in turn varies the signal current and therefore the signal voltage drop across R58, thereby amplitude-modulating the video signal. A dc voltage is added to the shading signal from a potentiometer on the shading board to set

the amount of amplitude modulation available. A dc voltage also is applied to the drain of Q6, via pin #3, from another potentiometer on the shading board to set the levels on the video signal that will and will not be modulated.

3-11. BLANKING INSERTER. During horizontal and vertical blanking intervals transistors Q9 and Q10 are held in the saturation state via amplifier Q8 with a negative-going composite blanking pulse received at board terminal 108. While the transistors are conducting the video line at both ends of R66 is clamped to ground. This cleans the video signal of spurious signals generated by retrace of the scanning beam at the camera and provides a fixed dc setup level.

3-12. GAMMA CORRECTOR. Gamma correction compensates for non-linear response to brightness levels of picture tubes in TV monitors and the image tube in the camera.

At the gamma corrector input the blanked video with an amplitude of about 1.5 volts p-p drives the bases of two transistors at U2-9 and U2-6 in integrated circuit U2. Both transistors are wired to operate as amplifiers with less than unity gain. The amplifier at U2-9 has a linear response while the one at U2-6 is logarithmic due to the non-linear impedance introduced into its base circuit by the diode formed by the transistor in U2 at terminals 3, 4 and 5. The point where this non-linearity begins occurs when white elements of the video signal become great enough in amplitude to overcome a dc bias set with GAMMA DC SET control R73 and developed across R74 with current supplied by emitter-follower U2-1, 2, 3.

At potentiometer R78 the two amplifier output signals are summed together to provide at the arm a video signal with selectable amounts of white compression. If the potentiometer arm is set at the end nearest to U2-7 the maximum compression is provided and the gamma factor is 0.4. If the arm is at the other end of the potentiometer no compression is introduced and the gamma factor is 1.0. A gamma factor between these two limits is selected when the arm is set at any other position.

3-13. OUTPUT AMPLIFIER. After gamma correction the video signal is coupled to the VIDEO output jacks on the rear of the camera control with a three-stage dc amplifier formed with transistors Q1 through Q5. The first stage (Q5, Q4, Q3) operates in a differential configuration and is stabilized for gain by dc feedback through R93, which is frequency-compensated with C37. The second and third stages (Q1 and Q2) operate as a feedback pair, the feedback causing the amplifier to have an output impedance that approaches zero. This low output impedance prevents coupling between the two VIDEO output jacks, both of which are driven through a 68-ohm distribution resistor (R99 and R100) to provide the required source impedance for the video output cables.

The amplifier gain normally is set with OUTPUT GAIN control R93 so the non-composite video signal amplitude at the VIDEO jacks is 700 millivolts when they are terminated with 75-ohm loads. A dc component selected with OUTPUT DC LEVEL control R86 is added to the video signal at the amplifier input. This dc signal, which is temperature-compensated with thermistor RT1, cancels out any dc offset that might otherwise be present in the video signal at the output of the amplifier.

3-14. SYNC INSERTER. When the video output signal is to be composite the mixed sync pulses are superimposed on blanking in the non-composite signal at the cable-terminating ends of distribution resistors R99 and R100. This is accomplished with transistor stages U1-8, U1-11, U1-1 and U1-5.

Transistors U1-8 and U1-11 amplify and invert the polarity of the negative-going horizontal, equalizing, and vertical sync pulses received at board terminal 103. The amplified pulses force transistors U1-1 and U1-5 to conduct, thereby clamping the two video output lines to a dc level established at the collectors by the current flow through the transistors in series with R103, as set with SYNC LEVEL control R105.

3-15. MANUAL-TARGET CONTROL. In systems with a vidicon camera, and if the TGT switch on the front of the camera control is set to MAN, target voltage may be adjusted manually with the GAIN control on the camera control front panel. This GAIN control varies the bias on differential-pair Q29 and Q30, which in turn varies the target voltage at the collector of Q29. Negative feedback provided by R147 stabilizes the control circuit and determines the maximum range of the manual target voltage.

3-16. AUTO-TARGET CONTROL. In systems with a vidicon camera, and if the TGT switch on the front of the camera control is set to AUTO, the auto-target control monitors the video output signal at a point prior to sync insertion and automatically compensates for variations in scene lighting by readjusting the vidicon target voltage.

The video signal is monitored at the junction of R131 and R132, from where it is amplified by a feedback amplifier with a differential input stage (Q24 and Q23) and a complementary-pair output stage (Q25 and Q26). The peak-to-peak amplitude of the amplified signal that appears at the Q25 and Q26 emitters is detected by capacitor C51 and diodes CR9 and CR10 to develop a dc signal. This dc signal charges capacitors C52 and C53 very rapidly to the detected level due to the short time constants of the charging circuit (R139-C52, R141-C53). Their discharge time constants (C52-R140, C53-R140) are much longer, however. Due to the long time constant of the discharge path (C52-R140, C53-R140) and a hysteresis effect provided by Zener CR11 sudden changes in video level are not seen and only a change which lasts several frames will cause the automatic target circuit to compensate the video level. The net effect is a simulated sample and hold operation.

The dc charge that appears across C53 drives a dc amplifier having a high-impedance input stage (Q27) and a constant-current output stage (Q28). The signal at the collector of Q28 is the target voltage. Negative feedback applied via C54 and R145 controls the response time of the amplifier to prevent low frequency oscillation. Pull-down provided by R150 determines the maximum range of the auto-target voltage.

3-17. +10 VOLT REGULATOR

Using a +20 volt regulated dc input signal, this regulator develops for independent use in the video processor a +10 volts dc that remains unaffected by variations in load current, temperature or powerline voltage.

The regulator, which also provides isolation for the video circuits, is mostly self-contained in U5, an integrated circuit containing in a single envelope a temperature-compensated reference voltage source, a differential amplifier and a Darlington series control. At U5-4 the differential amplifier compares the internal reference voltage with a sample of the +10 volt output taken from sensing network R117, R118. Any tendency of the +10 volts to change causes the amplifier to develop an error signal. This error signal changes the bias on the Darlington control circuit so as to allow more or less load current to flow and keep the +10 volts constant. Placed in series with the +10 volt output line is a 4.7 ohm resistor (R116). This resistor senses load current. If the load current attempts to exceed that for which the circuit is designed the voltage drop across the resistor takes over control of the Darlington control circuit and makes it operate as a current limiter.

3-18. DEFLECTION SUBASSEMBLY

Refer to both deflection schematics in Section IV. The deflection board in the camera control is either a type 8455801 or type 8455901. Both boards perform the same functions, the differences being how these functions are accomplished. The circuits on the 8455801 board will be discussed first, then those on the 8455901 board.

3-19. DEFLECTION BOARD 8455801 CIRCUIT DESCRIPTION (Dwg. 8455800)

Refer to Figure 3-4. The circuits on this board generate five repetitive waveforms and two dc control signals, and drive the target voltage-video output level meter on the front panel. Some of the generated waveforms, which are designated in the schematic as horizontal drive, horizontal trigger, horizontal clamp, vertical trigger and vertical deflection, are used in the camera control, while the others are routed on to the camera. The two generated dc control voltages are designated as horizontal size and horizontal centering, and both are used at the camera.



The circuits on the deflection board are described in detail in Paragraphs 3-20 through 3-26 under the following headings:

- a. Horizontal trigger and horizontal drive pulse generation (Paragraph 3-20);
- b. Horizontal clamp pulse generation (Paragraph 3-21);
- c. Vertical trigger pulse generation (Paragraph 3-22);
- d. Vertical deflection waveform generation (Paragraph 3-23);
- e. Horizontal centering control (Paragraph 3-24);
- f. Horizontal size control (Paragraph 3-25);
- g. Meter control (Paragraph 3-26).

In the discussions refer to Figures 3-5 and 3-6 for relative timing of waveforms.

3-20. HORIZONTAL TRIGGER/HORIZONTAL DRIVE PULSE GENERATION

Negative-going composite sync (Figure 1-3, 1-4 or 1-5) received at board terminal 16 from system synchronizing signal source initially is isolated from the line with surge-protection resistor R1 and buffer Q1. The pulses in the signal (A and L, Figures 3-5 and 3-6) then are reversed in polarity by inverter U1-11 and differentiated by C1, R6 to provide a positive triggering spike at the horizontal sync rate for one shot U2-3, U2-5 (C, Figure 3-5). When triggered, the one shot supplies a negative pulse at U2-3 and a positive pulse at U2-5. Both pulses have a duration which is set with R7 to equal about 70% of the horizontal line time so the one shot will not trigger during the equalizing and vertical sync intervals except at the horizontal line rate. The positive pulse at U2-5 is the horizontal trigger pulse and is supplied direct to board output terminal 12. The same pulse discharges C11 by turning on the transistor in U3 at terminals 1, 2 and 3. When the pulse ends this transistor stops conducting and C11 charges via R16 toward +20 volts. The resulting waveform across C11 is a sawtooth, with a positive ramp having a peak-to-peak amplitude determined by R16. When this sawtooth exceeds the voltage set by CABLE DELAY control R21, the transistor in U3 at terminals 3, 4 and 5 turns on to develop a delayed 6.35 microsecond negative-going horizontal drive pulse at the collector. An emitter follower, Q2, transfers this pulse to board output terminal 11. From there it is routed to the camera where it synchronizes horizontal scan.

3-21. HORIZONTAL CLAMP PULSE GENERATION

The leading edge of a negative horizontal sync pulse supplied by one-shot U2-3, U2-5 is differentiated by C6, R12, R11 to generate a triggering spike for pulse shaper U2-8. The pulse shaper, when activated, supplies at terminal 8 a positive pulse, the width of which is set to about 3 microseconds with CLAMP PULSE TIMING control R11. After differentiation by C17, R7 the trailing edge of this pulse activates gate U2-14, which causes the gate to supply a delayed 2 microsecond positive pulse at terminal U2-14. An inverter, U1-3, then reverses the polarity of this pulse to provide a negative-going, 2 microsecond, horizontal rate clamp pulse at board output terminal 13. From there the pulse is routed to the video processor and shading board option.

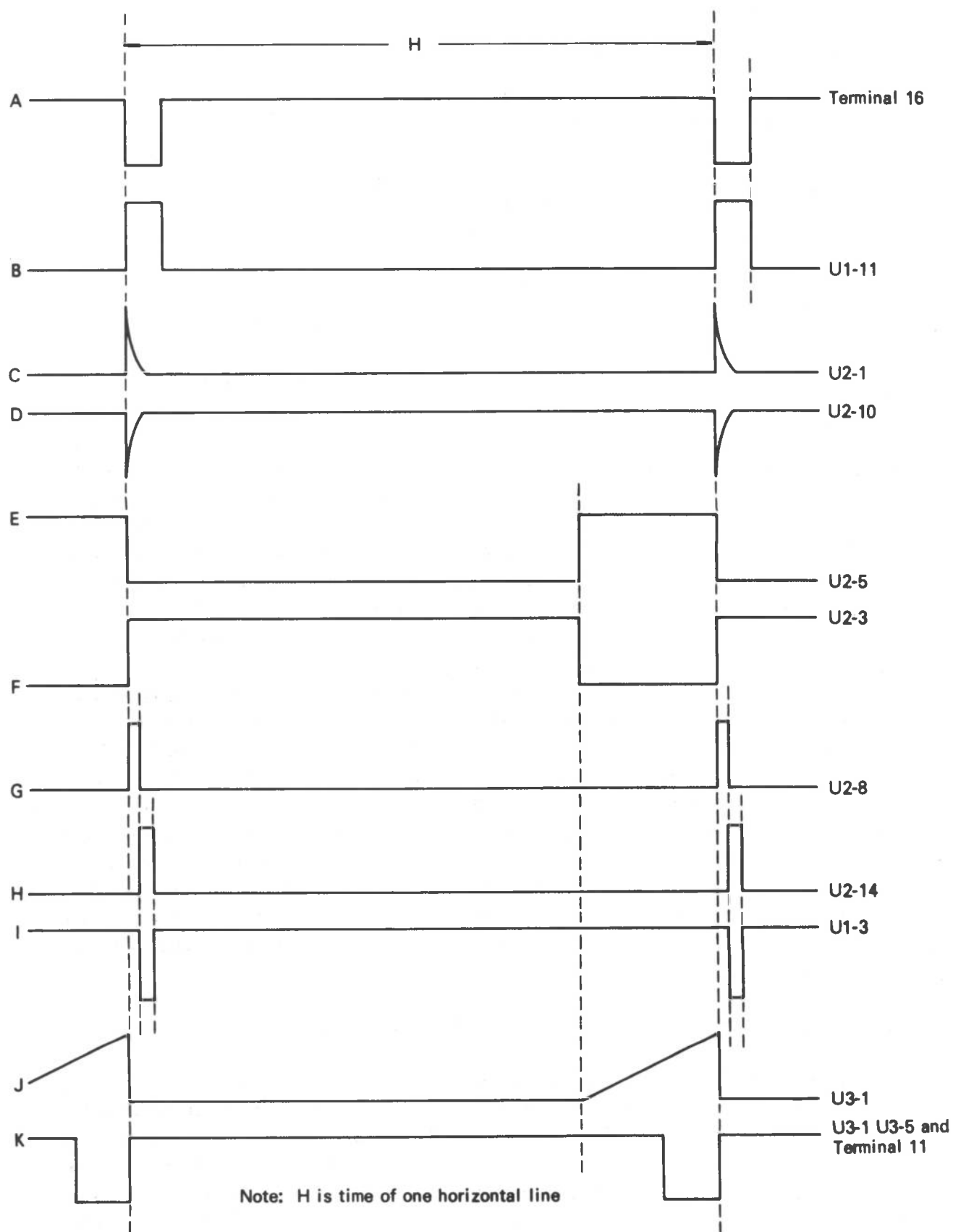


Figure 3-5. Deflection Board 8455801 Waveforms at Active Scan Times

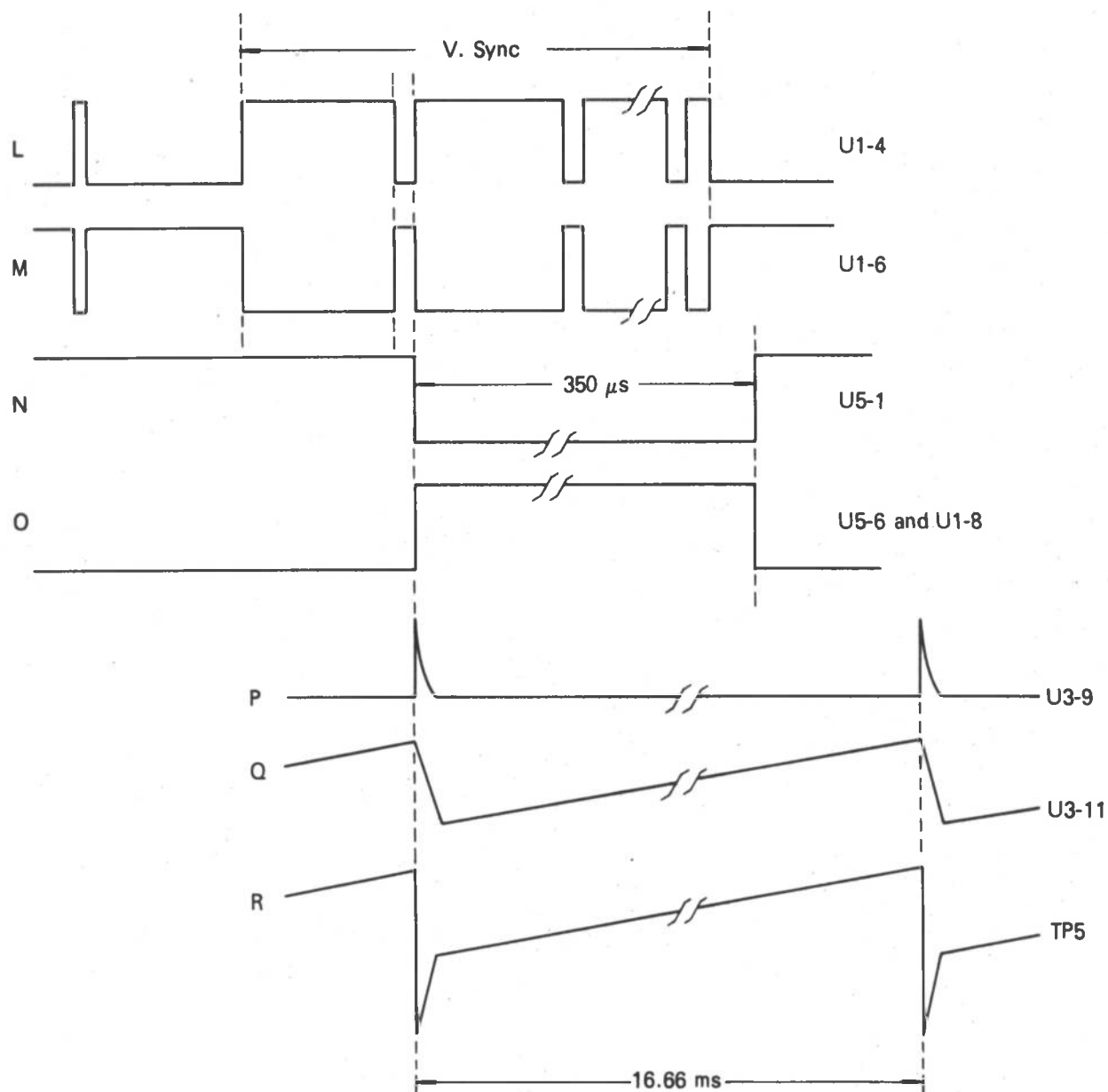


Figure 3-6. Deflection Board 8455801 Waveforms During Vertical Interval

3-22. VERTICAL TRIGGER PULSE GENERATION

The vertical trigger pulse is generated from the positive-going composite sync signal at output of inverter U1-11. After this sync signal is reversed in polarity by inverter U1-6, it is differentiated by C2, R28 and R29 to provide a negative-going horizontal-rate triggering spike for terminal 3 of gated one shot U5. Meanwhile, on another line, the positive-going composite sync signal from inverter U1-11 is applied to integrator R31, C5. At the first serration in each vertical sync pulse a sufficient positive charge develops on C5 to enable one shot U5 to be triggered with the differentiated serration pulse at U5-3, at which time a negative-going 350 microsecond pulse appears at U5-1 and a positive-going pulse of the same duration at U5-6. The negative pulse at U5-1 is reversed in polarity by inverter U1-8 and supplied as the positive-going vertical trigger pulse (O, Figure 3-6) at board output terminal 14 for use at the shading and blanking generator options.

3-23. VERTICAL DEFLECTION WAVEFORM GENERATION. At the start of the vertical retrace interval a positive 350 microsecond pulse is received from monostable multivibrator output terminal U5-6 (O, Figure 3-6). This pulse causes a transistor located in integrated circuit U3 at terminal 9 to conduct and discharge C15 and C18 to ground. When the pulse ends the transistor turns off and the two capacitors charge toward +20 volts via R37 for about 16 milliseconds. The resulting waveform across C15 is a sawtooth (Q, Figure 3-6) superimposed on a dc reference selected with vertical centering control R35. The positive ramp of the sawtooth corresponds to a horizontal line scan, and the dc reference establishes the vertical position of the scanning pattern at the image tube target. To ensure a linear ramp in the sawtooth, negative feedback is applied via R38 and R39, the vertical linearity control, thus compensating for the otherwise exponential charging of C15 and C18.

From C15 the sawtooth drives a two-stage power amplifier consisting of a differential input stage (U4) and a push-pull output stage (Q5). The push-pull stage drives the vertical deflection coil winding at the camera where it causes a sawtooth current waveform to develop. To prevent variations in coil copper resistance from affecting this current waveform the coil current is sampled at R40 to generate negative feedback for the power amplifier. The amount of feedback and therefore the gain of the amplifier is established by the setting of R40, which functions as a vertical size control.

3-24. HORIZONTAL CENTERING CONTROL. The horizontal centering control is an operational power amplifier that supplies an adjustable dc voltage for the horizontal deflection circuit at the camera. The amplifier is driven at U6-10 with a dc voltage selected with voltage divider R50, R51 and R52. The amplifier is powered with +11 volts dc supplied by a series regulator (U3-6, 7, 8).

3-25. HORIZONTAL SIZE CONTROL. The horizontal size control is a passive voltage divider with a coarse adjustment (R30) and a fine adjustment (R27) that allows selection of any dc voltage in the range from +1 to +20 volts. At the camera this dc voltage is used to control the amplitude of the sawtooth current waveform in the horizontal winding of the deflection yoke.

3-26. METER AMPLIFIER. Refer to Figure 3-7. Dependent on the setting of the METER switch on the camera control front panel, this circuit monitors either the target voltage at the camera or the video signal at the camera control output terminals and uses information therefrom derived to actuate the front panel meter. The video signal is amplified by Q4 and peak-detected by CR1, CR2, C28, C29 to develop a dc voltage. This dc voltage or the dc target voltage drives dc amplifier Q3, which forms one arm of a bridge with R66. Any voltage applied to the base of Q3 unbalances the bridge, thereby causing in the meter movement a current flow that is proportional to the amplitude of the signal being measured. The meter has a one milliamperere dc movement and is nulled for zero current with R63. R57 serves as the full-scale calibration control.

3-27. DEFLECTION BOARD 8455901 CIRCUIT DESCRIPTION (Dwg. 8455900)

The circuits on this board (Figure 3-8) are described in Paragraphs 3-28 through 3-34 under headings identical to those used for the 8455801 deflection board (Paragraph 3-13). For relative timing of waveforms refer to Figures 3-9 and 3-10.

3-28. H. TRIGGER AND H. DRIVE PULSE GENERATION. A negative-going composite sync signal (Figure 1-3, 1-4 or 1-5 and A, Figure 3-9 or L, Figure 3-10) received at board terminal 16 initially is isolated from the signal source with surge resistor R1 and buffer Q1. It then is reversed in polarity with inverter U1-11, after which it is used to trigger monostable multivibrator U6. When triggered, the multivibrator provides a negative pulse at U6-1 (C, Figure 3-9) and a positive pulse at U6-6 (D, Figure 3-9). The dc return for the multivibrator time constant is automatically controlled at U6-11 so the duration of these pulses will be about 70% of the horizontal line time for all scan rates, which prevents the multivibrator from being triggered during the vertical interval except with every other equalizing pulse or vertical serration. The positive pulse at U6-6 is fed to board terminal 12 where it serves as the horizontal trigger output pulse. The same pulse discharges C3 by forward-biasing Q8. When the pulse ends, Q8 turns off and C3 charges toward +20 volts through R8. The resulting waveform across C3 is a sawtooth (J, Figure 3-9) with a positive ramp. Via emitter follower Q9 this sawtooth simultaneously drives a peak detector (CR5), a dc amplifier (U7) and a comparator (U8). At the peak detector this causes to be produced at U7-6 a dc voltage proportional to the peak amplitude of the applied sawtooth and variable around an average level set with R14. This variable dc voltage serves as an automatically controlled bias voltage for previously described multivibrator U6. The same dc voltage is amplified by Q10 to provide automatic compensation with change in scan rate for peak detector CR5. At comparator U8, the input sawtooth waveform is applied at terminal U8-4. When the positive ramp of the sawtooth rises

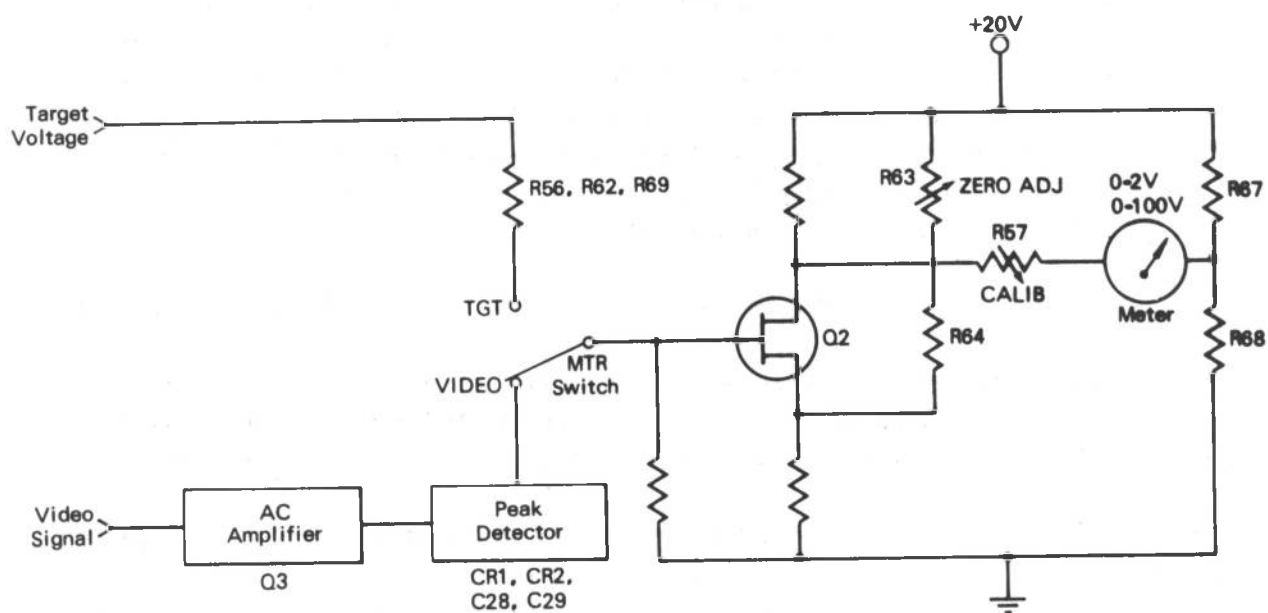


Figure 3-7. Meter Amplifier, Simplified Schematic

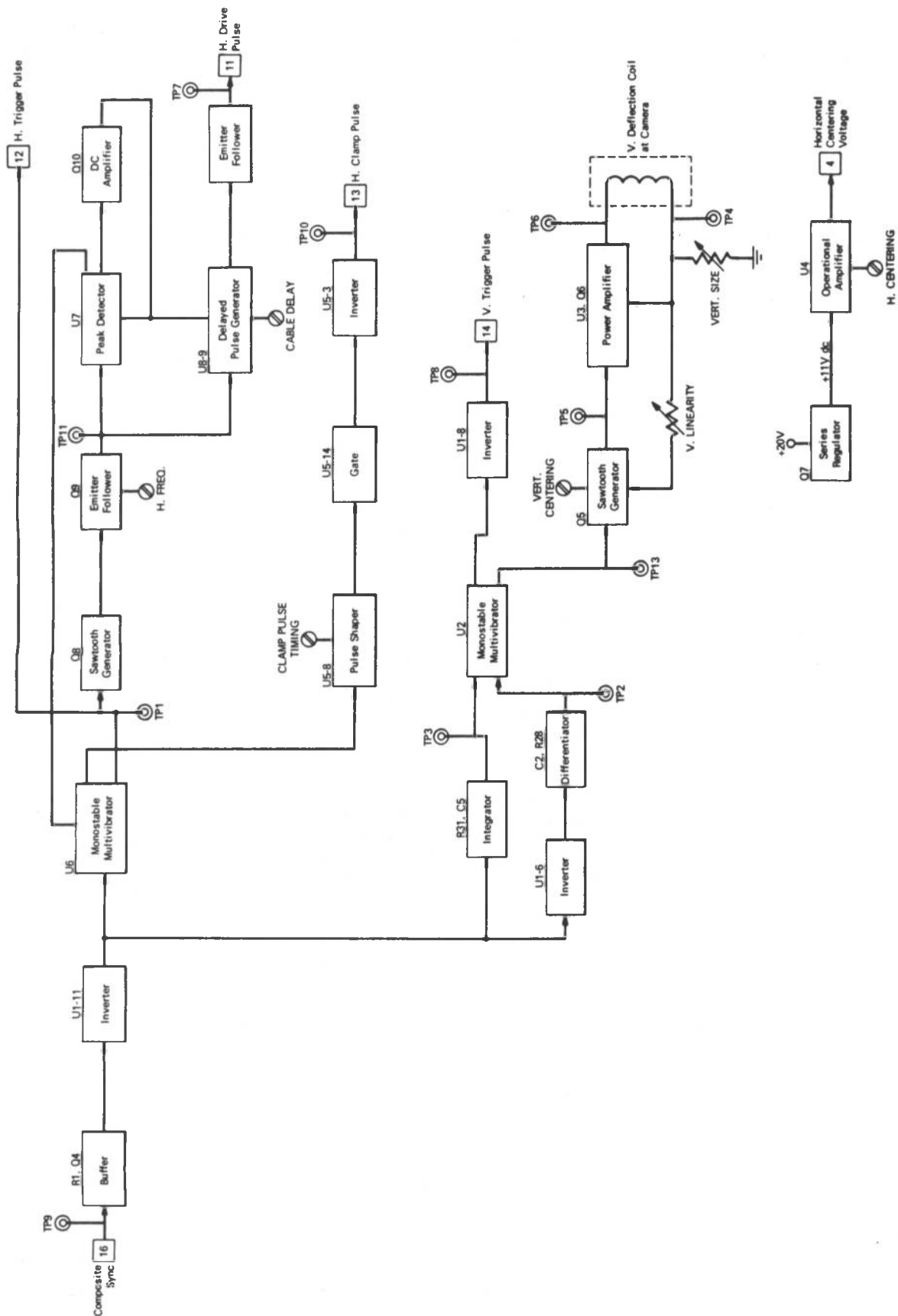


Figure 3-8. Block Diagram of Circuits on 845901 Deflection Board

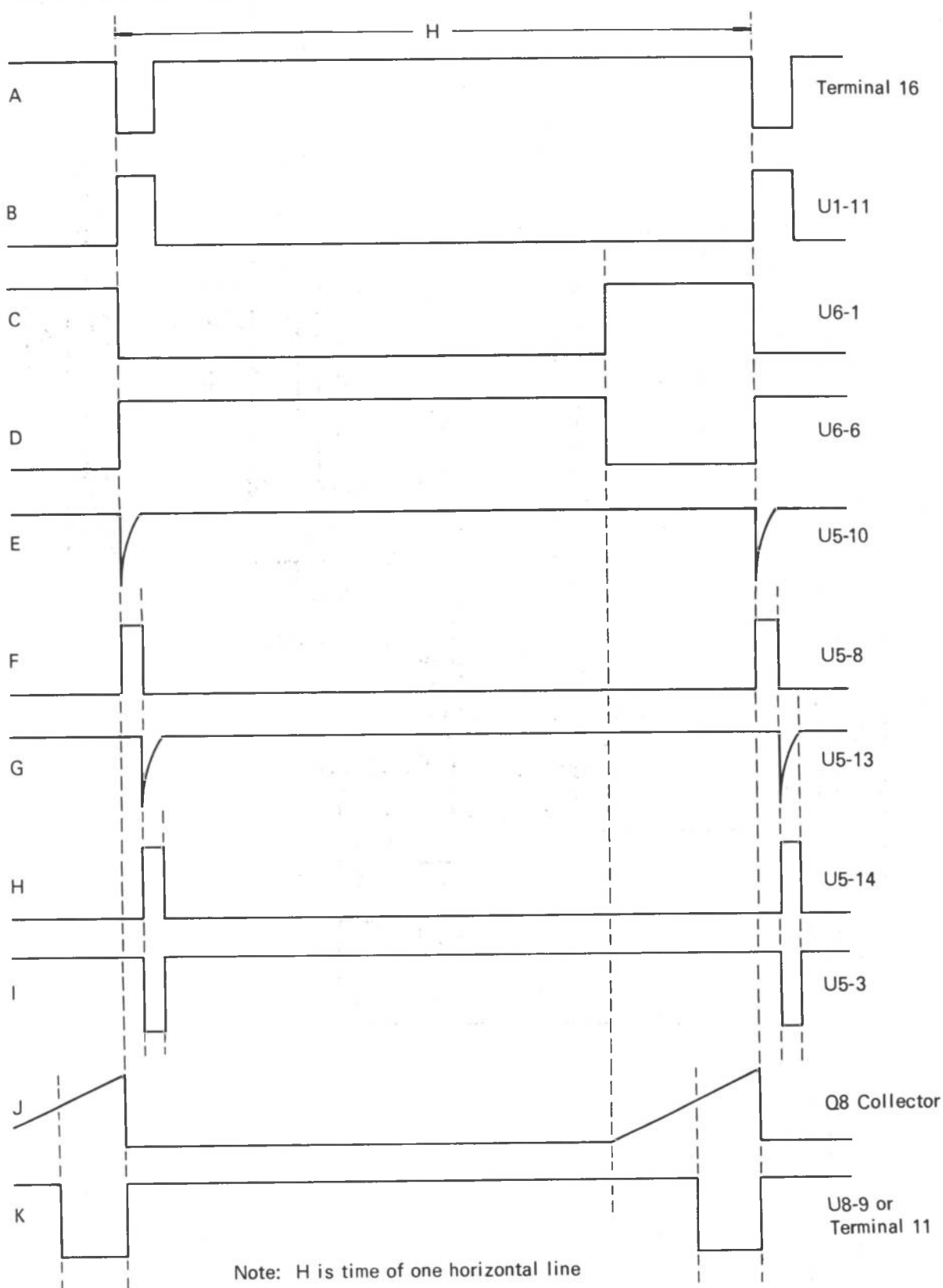


Figure 3-9. Deflection Board 8455901 Waveforms at Active Scan Times

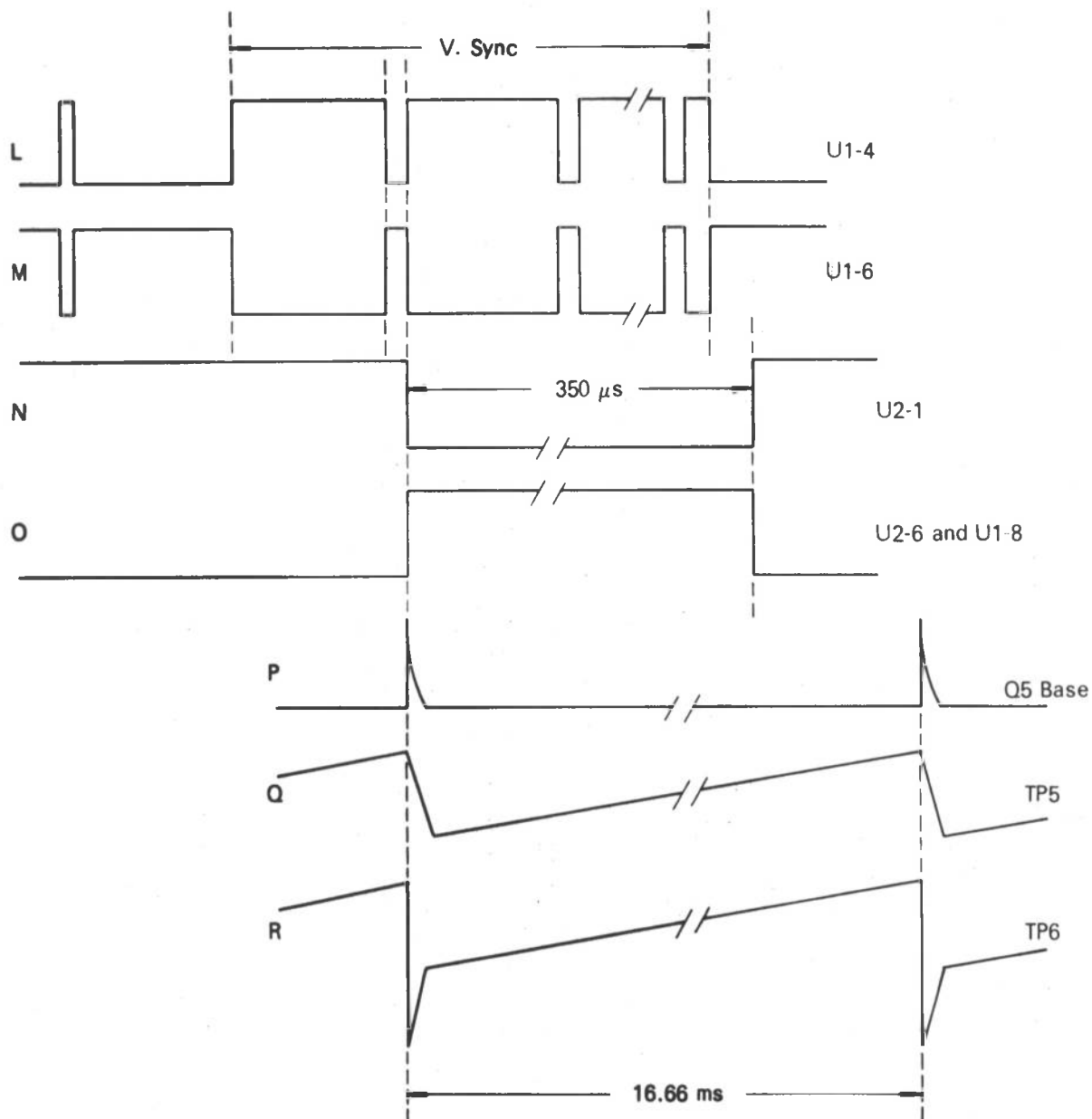


Figure 3-10. Deflection Board 8455901 Waveforms During Vertical Interval

to a level equal to that set with CABLE DELAY control R21 then U8 supplies a negative pulse at terminal U8-9 (K, Figure 3-9). Emitter follower Q1 couples this pulse to board terminal 11 where it serves as the horizontal drive output pulse. From terminal 11 the pulse is routed on to the camera where it triggers the start of each horizontal line scan.

3-29. HORIZONTAL CLAMP PULSE GENERATION. The leading edge of a negative-going horizontal sync pulse (C, Figure 3-9) generated at multivibrator U6 is differentiated by C6, R12, R11 to develop a triggering spike (E, Figure 3-9) for pulse shaper U5-8. The pulse shaper, when activated, supplies at terminal 8 a positive pulse (F, Figure 3-9) the width of which is set to about 3 microseconds with CLAMP PULSE TIMING control R11. After differentiating by C7, R17 the trailing edge of this pulse (G, Figure 3-9) activates gate U5-14. The gate then supplies at terminal U5-14 a 2 microsecond positive pulse (H, Figure 3-9), which is delayed approximately 3 microseconds with reference to the leading edge of horizontal sync (A, Figure 3-9). Inverter U5-3 reverses the polarity of this pulse to provide a 2 microsecond negative clamp pulse (I, Figure 3-9) at board output terminal 13. From there the pulse is routed to the video processor and optional shading board.

3-30. VERTICAL TRIGGER PULSE GENERATION. The positive-going composite sync signal (B, Figure 3-9 and M, Figure 3-10) at output of inverter U1-11 first is converted to the opposite polarity with inverter U1-6. The signal then is differentiated by C2, R28, R29 to generate a negative triggering spike at the horizontal line rate for gated one shot U2. On another line the positive-going composite sync signal from U1-11 is applied to integrator R31, C5. At the first serration in each vertical sync pulse the charge on C5 becomes positive enough to enable one shot U2 to be triggered with the differentiated sync serration at U2-3. When triggered, the one shot produces a negative 350 microsecond pulse at U2-1 (N, Figure 3-10) and a positive pulse (O, Figure 3-10) of the same duration at U2-6. The negative pulse is reversed in polarity by inverter U1-8 and supplied at board terminal 14 at the vertical trigger output pulse (O, Figure 3-10). From there it is made available for use at the optional shading and blanking generator options.

3-31. VERTICAL DEFLECTION WAVEFORM GENERATION. At the start of the vertical retrace interval at the camera the leading edge of a positive 350 microsecond pulse from U2-6 (O, Figure 3-10) causes transistor Q5 to conduct and discharges C15 and C18. When the pulse ends, the transistor turns off and the two capacitors charge toward +20 volts through R37, thereby generating a sawtooth (Q, Figure 3-10) with a positive ramp and a dc level that is selected with vertical centering control R37. The positive ramp corresponds in time to a horizontal line scan and the dc level establishes the vertical position of the scanning pattern at the image tube target. Negative feedback applied via R38 and R39, the vertical linearity control, corrects for the otherwise non-linear charging rate at C15 and C18.

From C15 the sawtooth waveform drives a two-stage power amplifier consisting of a differential input stage (U3) and a push-pull output stage (Q6). The latter supplies a signal (R, Figure 3-10) that causes a sawtooth current waveform to flow into the vertical deflection coil in the camera. The same coil current flows through R41 and vertical size control R40 to develop current feedback for both sawtooth generator Q5 and power amplifier U3, Q6. This feedback makes the amplifier function as a constant current generator, thus preventing variations in coil copper resistance from adversely affecting vertical deflection performance.

3-32. HORIZONTAL CENTERING CONTROL. The horizontal centering control supplies an adjustable dc voltage for use at the camera. The circuit consists of operation amplifier U4 and series regulator Q7. The latter provides the dc power (+11 volts) for U4, which amplifies a positive or negative dc voltage selected with horizontal centering control R51.

3-33. HORIZONTAL SIZE CONTROL. The horizontal size control is a passive voltage divider with a coarse adjustment (R89) and a fine adjustment (R90) that allow selection of any dc voltage in the range from about +1 volt to +20 volts. The selected voltage is used at the camera to control the amplitude of the sawtooth current waveform in the horizontal deflection coil winding.

3-34. METER AMPLIFIER. The meter amplifier on the 8455901 deflection board is identical to the one shown schematically in Figure 3-7 and described in Paragraph 3-26.

3-35. POWER SUPPLY SUBASSEMBLY (Dwg. 8455210)

Refer to Figure 3-11 and to the power supply schematic in Section IV. Most of the dc supply voltages required in the camera control and in the camera used with it are developed by the circuits in this subassembly. The supply voltages produced include regulated dc potentials of +20 volts, -10 volts, +5 volts, +300 volts, +6.3 volts, -100 volts, plus one potential that is adjustable between +55 and +125 volts and another that is adjustable between 0 and -100 volts. Power for the regulators is derived from four secondary windings on T1, a step-down power transformer that is mounted on the camera control chassis.

3-36. +20 VOLT REGULATED SUPPLY

Refer to Figure 3-12. AC power from a 23-volt secondary winding on power transformer T1 is converted to a smooth dc voltage with a diode bridge rectifier (CR1) terminated with a filter capacitor (C1). This dc voltage then is reduced to +20 volts by passing it through a Darlington series control circuit formed with two transistors. One of these transistors (Q1) is mounted on the camera control chassis; the other one is located in integrated circuit U1 at terminals 10 and 11.

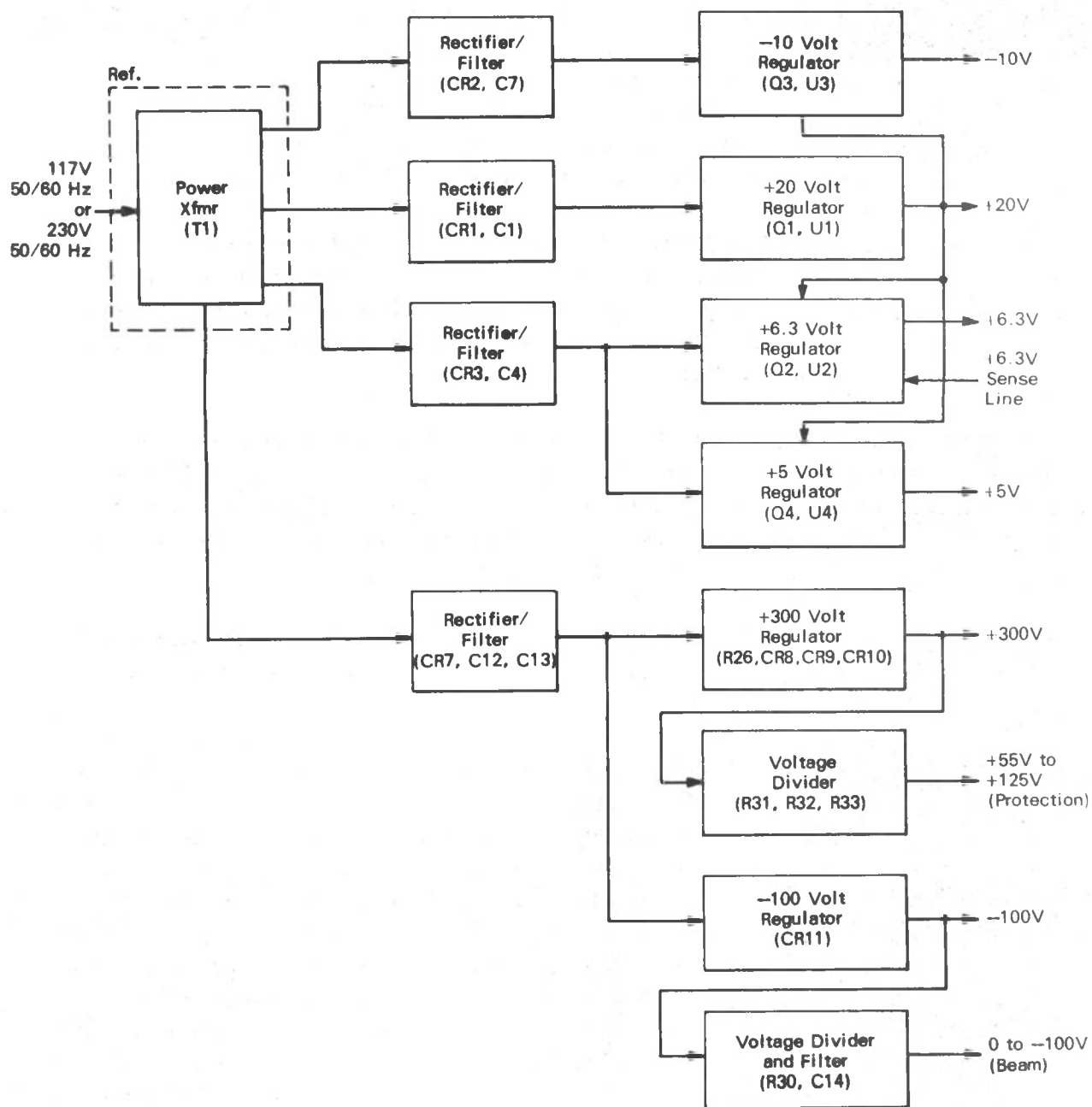


Figure 3-11. Power Supply Assembly Block Diagram

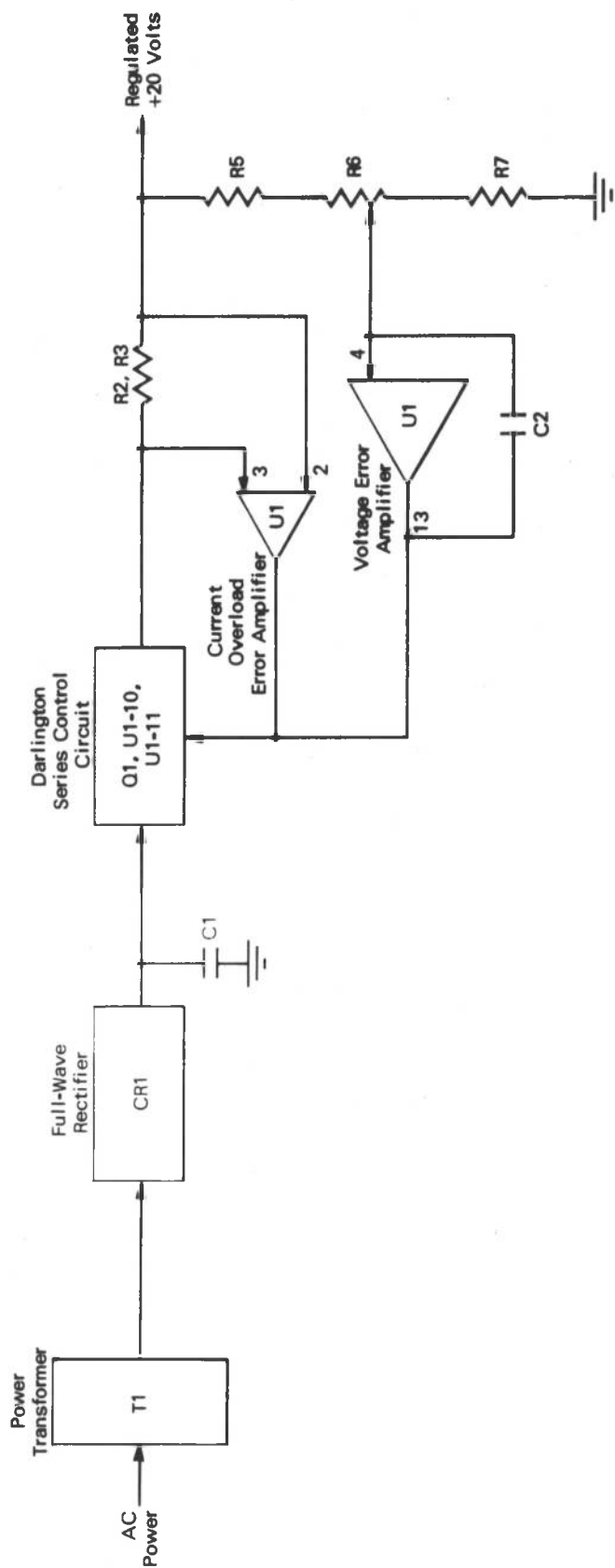


Figure 3-12. +20-Volt Regulated Supply

To regulate the +20 volts, the fraction of it that appears at the arm of R6 is compared with a reference voltage developed across a Zener located in U1. Any tendency of the +20 volts to deviate from normal, as preset with R6, results in an error signal. This error signal, after amplification by a high-gain differential amplifier located in U1 between terminals 4 and 13, is used in a closed-loop arrangement to adjust the current through the Darlington series control circuit up or down, as needed to restore the voltage drop across the load on the +20-volt line to the preset level.

To protect the regulator from current overload, the voltage drop developed across R2 and R3 by the load current is sensed at the input of a differential amplifier located in integrated circuit U1 at terminals 2 and 3. If the current drain on the supply rises above the point where a voltage drop of 0.7 volt or more is developed across R2 and R3 an error signal appears at the output of the amplifier. This error signal drives the bias on the Darlington series control circuit more negative, which, in effect, makes the supply regulate in the constant-current mode so it will limit the load current to a safe level.

3-37. +5 VOLT AND -10 VOLT SUPPLIES

The circuits for these two supplies are similar in operation to the +20 volt supply described in preceding paragraph, with the exception that the reference voltage used for comparison with the output voltage is that appearing on the +20-volt output line. Therefore, all three supplies are referenced to the same Zener in U1 and the +5 and -10 volt outputs will follow any small changes occurring in the +20 volt supply.

3-38. 6.3 VOLT SUPPLY

This supply develops the voltage that is applied to the filament of the image tube in the camera. The circuit is similar to the +20 volt supply described in Paragraph 3-35, with the exception that the reference voltage used for comparison purposes is the sum of the regulated +20 volt output and the voltage loss introduced by the line that conducts the filament current to the camera. This voltage loss is sensed through another line that is tied to common at the image tube socket. For long cable runs additional voltage taps are provided on the secondary winding of the power transformer so the supply voltage can be increased to compensate for the increased voltage drop in the line, if needed.

3-39. +300 VOLT AND -100 VOLT SUPPLIES

The ac power for these two supplies comes from the same 470-volt secondary winding on power transformer T1. In a diode bridge rectifier formed with CR4, CR5, CR6 and CR7, the ac voltage is converted into a dc potential of about 600 volts across filter capacitors C12 and C13. A 200-volt drop across R26 reduces this potential to 400 volts at the junction of R26 and CR8, with reference to the

junction of C13 and R28. The 400 volts is regulated by Zener diodes CR8, CR9 and CR10. By grounding the junction of CR10 and CR11 regulated potentials of +300 and -100 volts are obtained with reference to this ground.

The regulated +300 volts, in addition to being an output voltage, also is applied to voltage divider R31, R32 and R33. At the junction of R32 and R33 a voltage is provided that is adjustable over a range from about +55 to +125 volts with R50. This voltage is used to energize the deflection failure indicator on the front panel and is set for a specific threshold level.

A voltage divider (R43) is also placed between the regulated -100 volt line and ground to provide a stable voltage that is adjustable between 0 and -100 volts with R43, the BEAM control. The voltage at the arm of R43 is used on grid 1 of the image tube in the camera to control the density of the electron beam.

3-40. OPTIONAL SHADING CORRECTION CIRCUIT (Dwg. 8459500)

Refer to the shading circuit schematic in Section IV. This optional circuit attaches to the video board subassembly. Its function is to compensate for non scene-dependent signals generated at the camera while the scanning beam in the image tube is tracing. These undesired signals result from non-uniformity in the photo-conductivity of the target, from beam-landing errors, and from light loss in the optics.

The remedy used is based on the fact that interference patterns produced in a televised scene from these spurious signals are repetitive and can be eliminated by superimposing various combinations of sawtooth and parabolic waveforms on the video signal at line and field rates. The arrangement of the circuit that provides the remedy is shown in Figure 3-13. The circuit descriptions in Paragraphs 3-41 through 3-46 are keyed to this illustration.

3-41. VERTICAL RATE SAWTOOTH AND PARABOLIC WAVEFORM GENERATION

The vertical rate sawtooth waveform is generated by first inverting and amplifying at Q1 a vertical trigger pulse waveform received at board terminal 7. The inverted pulse then drives integrating amplifier U1-7, which generates a sawtooth by charging C5 at a slow rate and discharging it at a fast rate.

The vertical rate parabolic waveform is developed by charging and discharging C5 at an exponential rate with integrating amplifier U1-7, which is driven at U1-6 with the sawtooth waveform generated at U1-7.

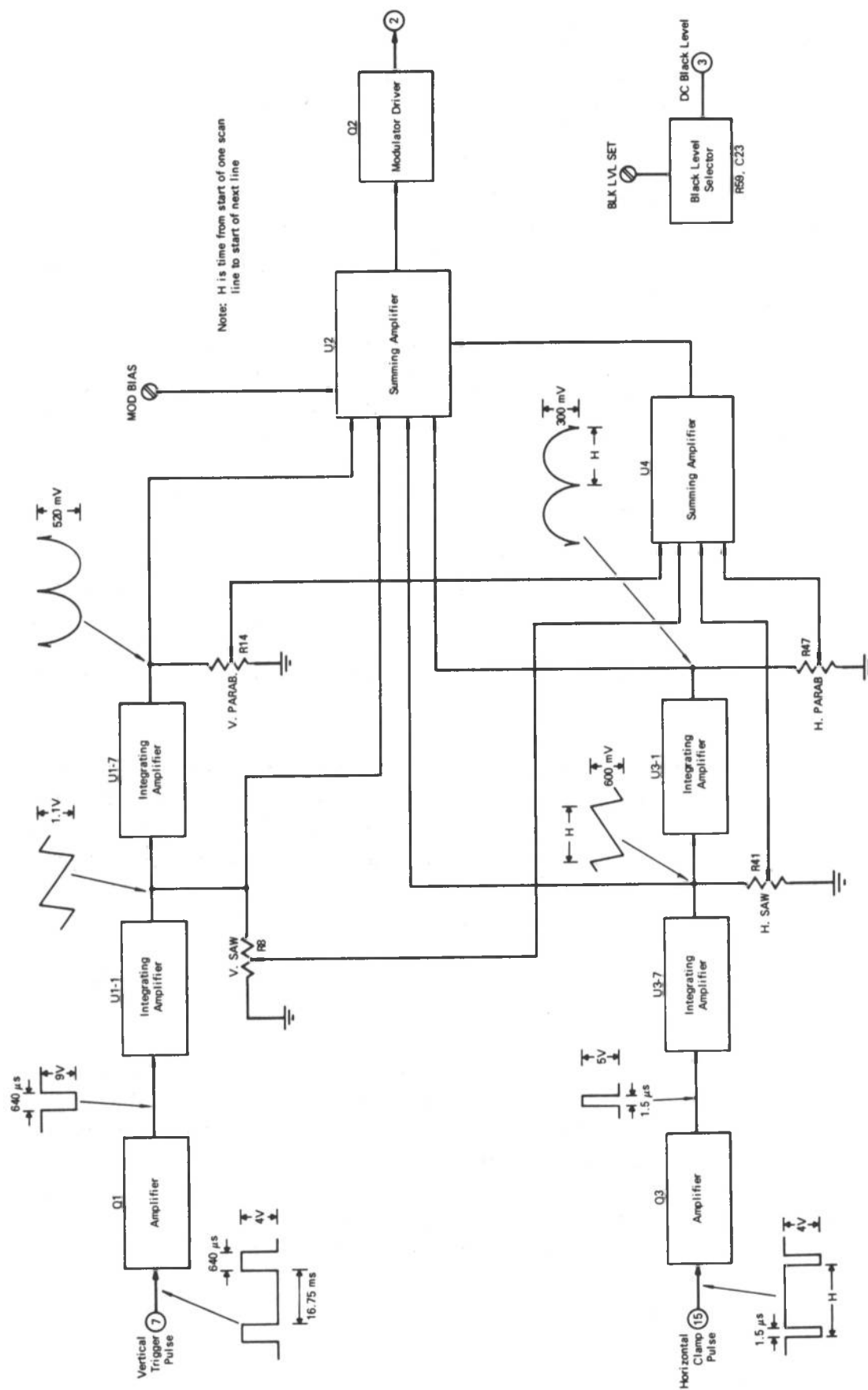


Figure 3-13. Shading Board Block Diagram

3-42. HORIZONTAL RATE SAWTOOTH AND PARABOLIC WAVEFORM GENERATION

Both of these waveforms are generated in the same manner as the vertical rate waveforms described in the preceding paragraph. The sawtooth is developed at C14 with integrating amplifier U3-7, which is driven via inverting amplifier Q3 with a horizontal clamp pulse received at board terminal 15. Likewise, the horizontal rate parabolic waveform is developed at C17 with integrating amplifier U3-1, which is driven with the horizontal rate sawtooth waveform at C14.

3-43. WAVEFORM SUMMATION

The generated vertical and horizontal rate sawtooth and parabolic waveforms at C2, C5, C14 and C17 are summed via R20, R21, R22 and R23 at the input of operational amplifier U2-11. The same waveforms are attenuated by selectable amounts at shading controls R8, R14, R41, R47 and then summed together via R51, R52, R53 and R54 at the input of operational amplifier U4-11. The output of this amplifier is a composite signal, all components of which are opposite in polarity to their counterparts in the composite signal developed at the input of operation amplifier U2-11 by the unattenuated sawtooth and parabolic waveforms.

The two composite signals are added together algebraically via summing resistor R24 at the input of operational amplifier U2-11 to produce at the amplifier output a composite signal with sawtooth and parabolic waveforms that are reversible in polarity and adjustable in amplitude with shading controls R8, R14, R41 and R47. From U2-11 the resultant signal is used to drive Q2 through frequency compensated (C7) zener CR1, which enables Q2, with its lower dc output level, to drive Q2, with its higher dc input level. Q2 then serves as a driver for the shading modulator on the video processor board.

3-44. BLACK LEVEL CONTROL

The black level control is a passive voltage divider (R59) used to adjust the dc operating point at the drain of the shading modulator on the video processor board. The dc operating point is set with this control so minimum shading modulation occurs at the black level in the video signal. The voltage selected with R59 will be positive if the video signal at the camera control output terminals is to be white-negative; otherwise it will be negative.

3-45. DECOUPLERS

The circuits on the shading board require dc power of -9.5 volts, +9.5 volts, +20 volts and -6.8 volts to operate. The +9.5 and -9.5 volt supplies are derived from input voltages of +10 volts and -10 volts with passive line decouplers R63, C26, C27 and R65, C29, C30. The -6.8 volt supply is derived from the -10 volt dc input, regulated with zener diode CR2 and resistor R66, and decoupled with passive line decoupler R66 and C32.

3-46. MODULATOR BIAS CONTROL

The mod bias control (R17) is used to adjust the dc operating point at the gate of the shading modulator on the video processor board. A dc voltage selected with R17 is summed into summing amplifier U2 via summing resistor R19. This controls the dc output level of U2, Q2 and thereby the dc operating point of the shading signal. This dc operating point is set for the proper amount of shading modulation available with the shading controls.

3-47. SYNC GENERATOR OPTION

This optional plug-in circuit generates composite sync and blanking pulses like those specified under "Input Signal Requirements" in Table 1-1, and, if utilized, it eliminates the necessity of providing these pulses from some external source.

Two types of sync generators are available for 6950 Series Camera Controls. One version produces composite sync and blanking pulses for 525-line, 30-frame, 2:1 interlace scanning patterns that conform to EIA RS-170 Specifications (Figure 1-3). This generator is described in a Code 6X-521 6000 Series Fixed Scan Rate Sync Generator Instruction Manual. The other version produces composite sync and blanking pulses that conform to EIA RS-330 Specifications (Figure 1-4) for 525-line, 30-frame, 2:1 interlace scanning patterns, or to EIA RS-343 Specifications (Figure 1-5) for 675- through 1225-line, 30-frame, 2:1 interlace scanning patterns. This generator is described in a "6000 Series Variable Scan Rate Sync Generator Instruction Manual" (Code No. 6X-520).

When either of the aforementioned sync generators is in the camera control the pulses they develop are made available at SYNC OUT and BLANK OUT connectors on the rear of the camera control and may be used additionally for simultaneous synchronization of several television systems.

3-48. BLANKING GENERATOR OPTION

This optional plug-in circuit generates composite blanking pulses such as those specified under "Input Signal Requirements" in Table 1-1. If used, it eliminates the need for an external blanking signal source. The blanking pulses provided by it are synchronized to the composite sync signal also specified under "Input Signal Requirements" in Table 1-1. This generator is described in a "6000 Series Blanking Generator Instruction Manual" (Code No. 6X-526). When it is in the camera control the pulses it produces are made available at a BLANK OUT connector at the rear of the camera control and may be used additionally with other systems that are synchronized to the same composite sync signal.

SECTION IV

MAINTENANCE

4-1. INTRODUCTION

This section of the manual details procedures that may be performed periodically to optimize camera control performance. Information also is included that will aid in isolating malfunctions and making repairs.

4-2. TEST EQUIPMENT REQUIREMENTS

The following test equipment is recommended for the maintenance procedures outlined in subsequent paragraphs:

- a. Calibrated, wideband dual-trace laboratory quality oscilloscope with a low-capacity probe (Tektronix 545 with 1A1 Preamplifier and P6008 low-capacity X10 attenuator probe, or equivalent);
- b. Sweep frequency generator with sweep widths up to 50 MHz (Kay Electric 154 or equivalent);
- c. High-impedance dc voltmeter with 0.1% accuracy or better;
- d. Camera test jig equipped with 1600 line resolution chart and a RETMA linearity chart (Cohu, or equivalent).

NOTE

In lieu of the test jig the resolution and linearity charts at the back of this manual may be used. However, due to printing deficiencies and possible paper shrinkage, resolution measurements may not be completely accurate.

- e. Dot-bar generator that provides test patterns for television systems having scan rates from 525 lines/frame through 1225 lines/frame (Cohu DBG-2, or equivalent);
- f. Vidicon simulator (Cohu, or an equivalent). For exact Cohu type refer to camera instruction manual.

4-3. DISASSEMBLY

6950 Series Camera controls are designed to allow easy access to all circuits for testing, adjustment or repair. The majority of the circuits are installed on three etched-circuit boards (four if the shading circuit option is included and five if the sync generator or blanking generator option also is included). All of these circuit boards, with the exception of the shading circuit, are plug-in units that fit in receptacles at an inter-connection board on a subchassis at the locations shown in

Figure 4-1. The shading circuit board bolts to the video processor board and is tied to it electrically with 10 plug-in wire leads. Any active components not located on the aforementioned boards are either bolted to the subchassis or installed on an etched-circuit terminal board (A5 in wiring diagram) that is bolted to the subchassis (see Figures 4-2, 4-3 and 4-4).

4-4. PLUG-IN CIRCUIT BOARD REMOVAL

To remove a plug-in etched-circuit board for servicing:

- a. Open the hinged door on the front of the camera control housing;
- b. Except in the case of the shading board option, pull the board out of the subchassis receptacle from the front using the handle on the front edge of the board. To position the shading board for servicing, first pull out the video processor board to which it is attached; then remove the bolts holding the two boards together on the unhinged side and rotate the shading board on its hinge so it is positioned at right angles to the video processor board.

4-5. SUBCHASSIS REMOVAL

When servicing the camera control it may be desirable in some instances to remove the main subchassis (Figure 4-2) from the case. To accomplish this:

- a. Loosen, at the rear of the camera control case near the bottom edge, the holding screw (Figure 4-4) that secures the subchassis in the case;
- b. Slide the subchassis out of the case from the rear.

4-6. LOCATING COMPONENTS

The locations of subassemblies and chassis-mounted components can be determined with the aid of Figures 4-1 through 4-4. Individual components on etched-circuit boards are clearly labeled with circuit designators where they are installed.

4-7. PREVENTIVE MAINTENANCE

Preventive maintenance required occasionally by the camera control consists of cleaning the interior (Paragraph 4-8) and making internal adjustments (Paragraph 4-9).

4-8. CLEANING

The interior of the camera control should be cleaned as often as experience indicates is necessary to prevent dust or grime from accumulating. For cleaning, use forced air or a vacuum and a soft-bristle brush. Handle etched-circuit

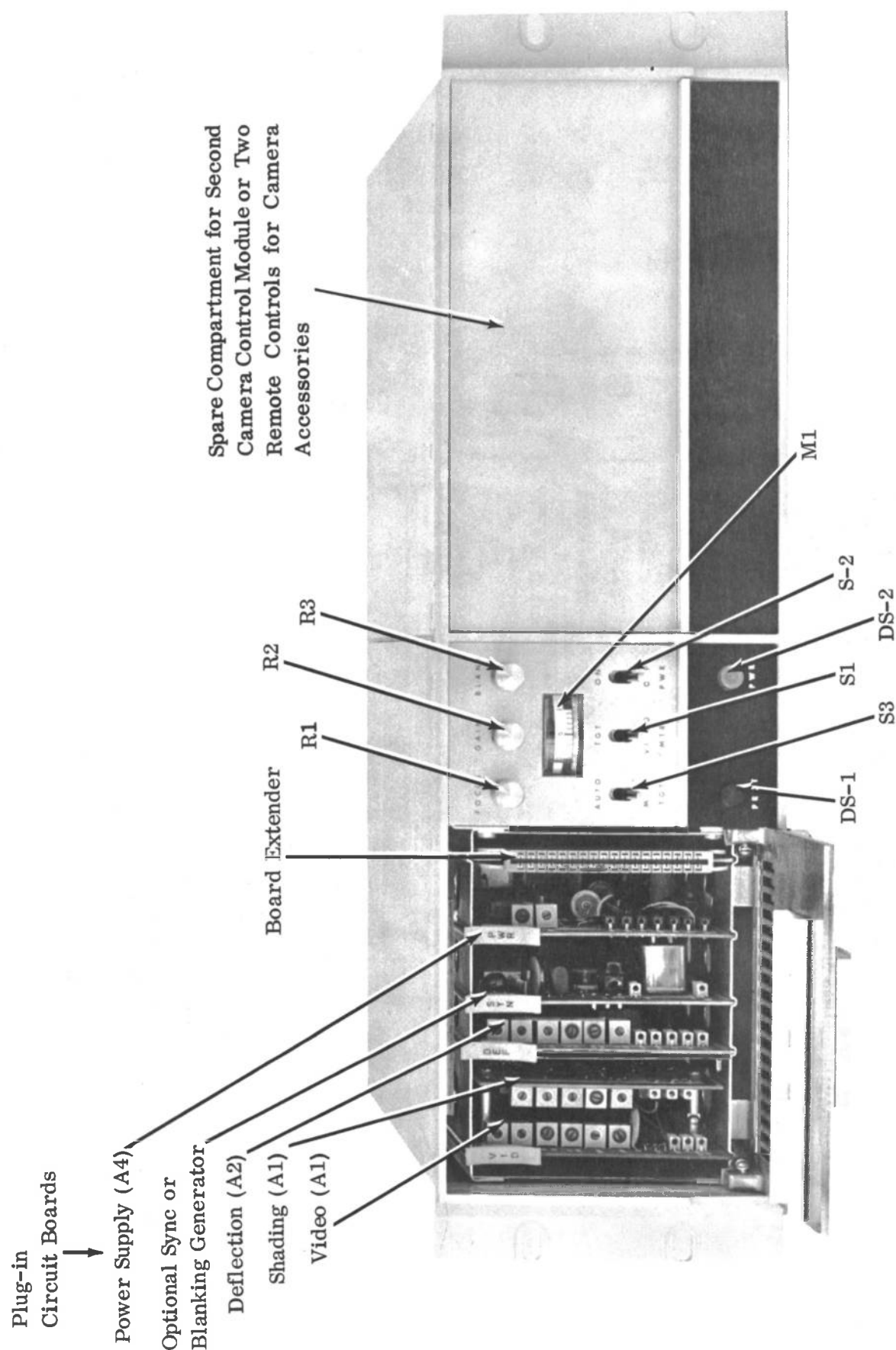


Figure 4-1. Camera Control with Front Door Open

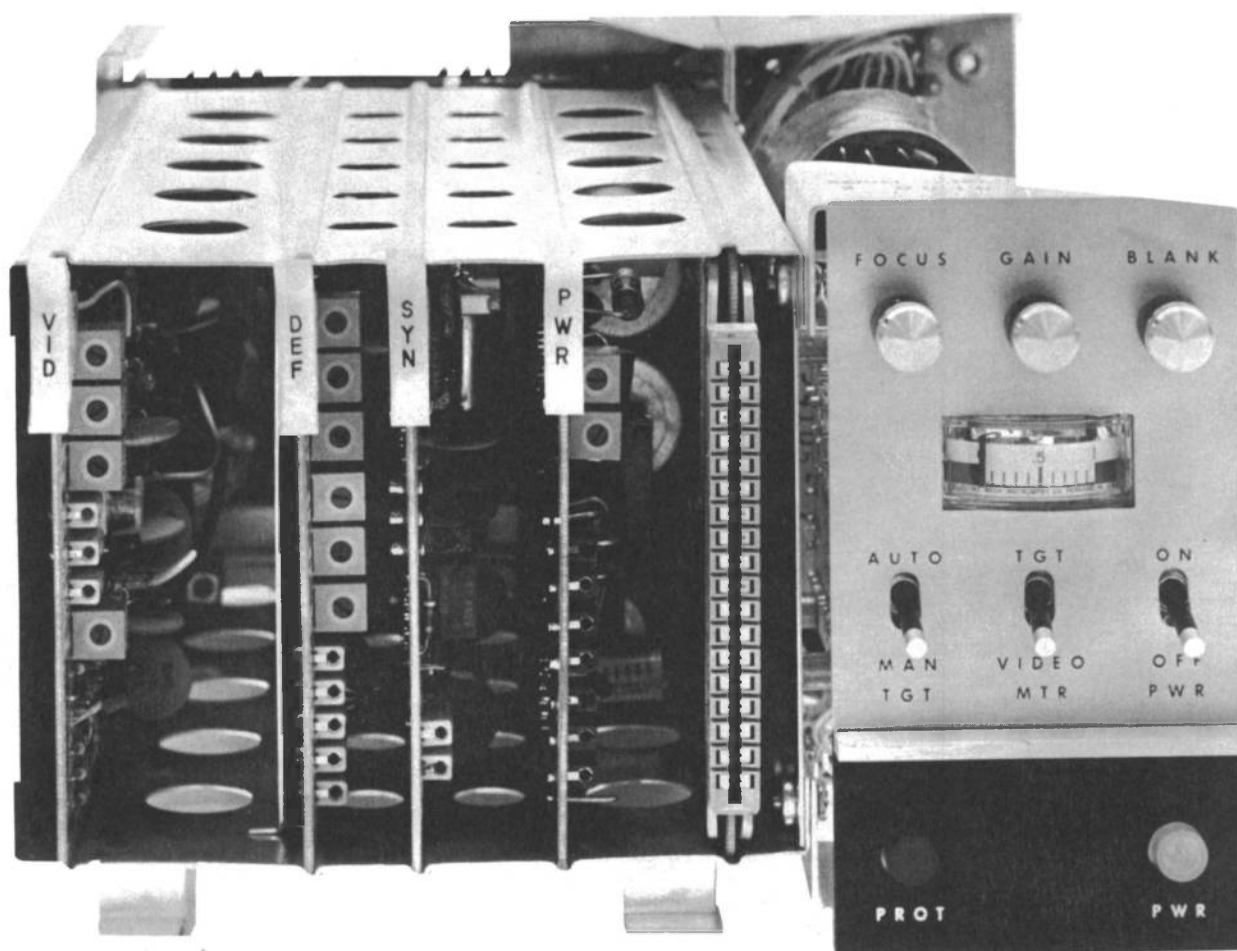


Figure 4-2. Camera Control Main Subchassis, Front View

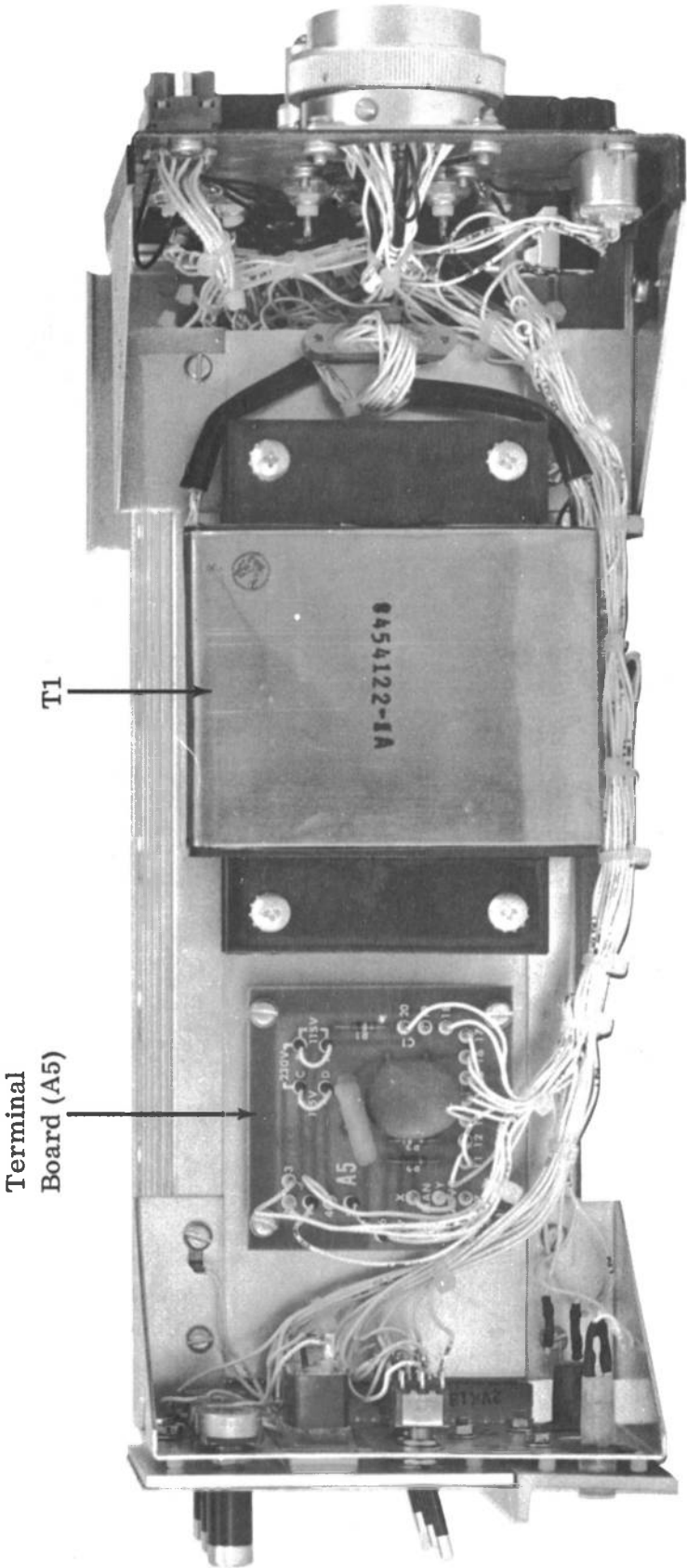
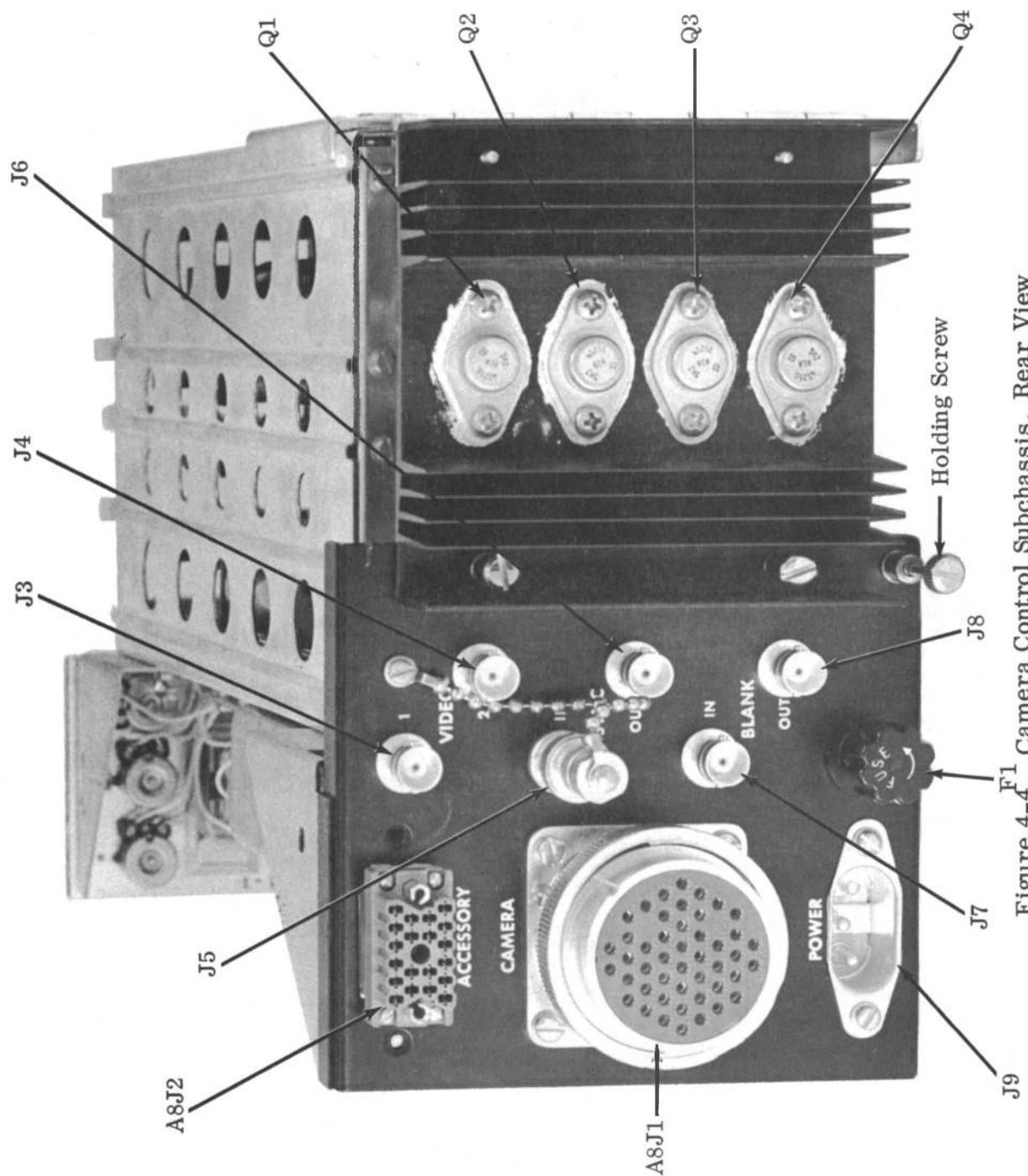


Figure 4-3. Camera Control Subchassis, Right Side View



boards carefully; otherwise leads on components or etched-circuit paths could be broken.

4-9. INTERNAL ADJUSTMENTS

Internal adjustments that can be made after component replacement or periodically to optimize camera control performance are outlined below. The internal controls used for these adjustments and their locations are listed in Table 4-1. For the most part these controls, as well as some of the more important test points, are located on the front ends of the plug-in circuit boards (Figures 4-1 and 4-2). The other test points and internal adjustments, except those on the sync generator and blanking generator options, are located approximately as shown in Figures 4-5 through 4-9. The board extender accessory (Figure 4-1) supplied as standard equipment with the camera control may be inserted between any of the plug-in circuit boards and its receptacle in the subchassis as in Figure 4-10 to make those controls and test points not on the ends of the boards accessible.

Table 4-1. Internal Adjustable Controls

LOCATION	NAME	CKT. REF.	FUNCTION
Video processor board (Figure 4-5)	GAIN	R3	Sets video gain for input stage
	Static dark current compensation	R13	Sets amount of compensation provided for dc dark current variations resulting from relatively slow changes in scene lighting
	Dynamic dark current compensation (not used on boards with serial number 1-0025 or lower)	R12	Sets amount of compensation provided for transient dark current variations resulting when switching from a lighted to a totally black scene
	Setup compensation (not used on boards with serial number 1-0025 or lower)	R150 or R151	Adjusts setup level of negative video signal over a narrow trim range. (The control is inoperative unless negative-white video output polarity is selected)
	PHASE	R22	Adjusts phasing of higher-frequency components in video signal, thus compensating for phase shifts resulting from transmission of the signal through reactive paths

Table 4-1. Internal Adjustable Controls (cont.)

LOCATION	NAME	CKT. REF.	FUNCTION
Video processor board (Figure 4-5) (cont.)	Aperture frequency trim	L1	Selects frequency at which aperture correction peaks
	APT	R28	Sets amount of aperture correction
	High frequency gain	L2	Trims video response at high end of bandpass
	WHT PEAK CLIPPER	R57	Sets peak white level above which video signal components are clipped to eliminate specular highlights
	DC SET	R73	Sets dc level of video signal at gamma corrector
	GAMMA	R78	Adjusts video gain versus light level response
	OUT DC LVL	R86	Zeroes dc level in video output signal
	OUT GAIN	R93	Sets video amplitude at camera control output terminals
	SYNC LEVEL	R105	Sets sync amplitude in composite video signal at camera control output terminals
	High frequency trim	C37	Trims over a narrow range the video gain at high end of bandpass
Deflection board (8455801) (Figure 4-6)	H. CENT	R51	Moves scanning pattern left or right on target at camera
	V. CENT	R35	Moves scanning pattern up or down on target at camera
	H. SIZE	R27	Adjusts width of scanning pattern on target over a narrow trim range
	COARSE H. SIZE	R30	Adjusts width of scanning pattern on target over a wide range
	VERT SIZE	R40	Adjusts height of scanning pattern on target

Table 4-1. Internal Adjustable Controls (cont.)

LOCATION	NAME	CKT. REF.	FUNCTION
Deflection board (8455801) (Figure 4-6) (cont.)	SAW AMPL	R16	Sets a reference used in advancing of horizontal scan to compensate for video signal delays
	CABLE DELAY	R21	Adjusts timing of horizontal scan with reference to leading edge of horizontal sync
	CLAMP PULSE TIMING	R11	Adjusts timing of horizontal clamp pulse with reference to leading edge of horizontal sync
	CALIB	R57	Calibrates full-scale reading of target voltage/video output level meter on front panel
	ZERO ADJ	R63	Zeroes target voltage/video output meter on front panel
	SAW DELAY	R7	Sets a reference used in timing of horizontal scan
	VERT LIN	R39	Adjusts for equal spacing between adjacent horizontal lines in scanning pattern
Deflection board (8455901) (Figure 4-7)	CLAMP PULSE TIMING	R11	Adjusts timing of horizontal rate clamp pulse generated for use at video processor and supplied at board output terminal 13
	CABLE DELAY	R21	Adjusts timing of horizontal scan with reference to leading edge of horizontal sync
	COARSE H. SIZE	R89	Adjusts over a wide range the width of the scanning pattern on target at camera
	H. SIZE	R90	Adjusts over a narrow trim range the width of scanning pattern on target at camera
	VERT SIZE	R40	Adjusts height of scanning pattern on target at camera

Table 4-1. Internal Adjustable Controls (cont.)

LOCATION	NAME	CKT. REF.	FUNCTION
Deflection board (8455901) (Figure 4-7) (cont.)	VERT CENT	R40	Adjusts position of scanning pattern up or down at target in camera
	H. CENT	R51	Adjusts position of scanning pattern left or right at target in camera
	VERT L/N	R39	Adjusts for equal spacing between adjacent horizontal lines in scanning pattern
	CALIB	R57	Calibrates full-scale reading of target voltage/ video output level meter on front panel
	ZERO	R63	Zeroes target voltage/ video output level meter on front panel
Power Supply Board (Figure 4-8)	BEAM	R30	Adjusts beam current at image tube in camera
	PROT	R33	Sets threshold level of deflection failure indicator circuit
	+20V	R6	Calibrates +20 volt regulated supply
Optional Shading Board (Figure 4-9)	H. SAW	R41	Selects polarity and sets amplitude of sawtooth waveform that modulates video signal at horizontal line rate to compensate for non scene-dependent signals generated at camera
	H. PAR	R47	Selects polarity and sets amplitude of parabolic waveform that modulates video signal at horizontal line rate to compensate for non scene-dependent signals generated at camera
	V. SAW	R8	Selects polarity and sets amplitude of sawtooth waveform that modulates video signal at field rate to compensate for non

Table 4-1. Internal Adjustable Controls (cont.)

LOCATION	NAME	CKT. REF.	FUNCTION
Optional Shading Board (cont.)	V. SAW (cont.)	R8 (cont.)	scene-dependent signals generated at camera
	H. PAR	R14	Selects polarity and sets amplitude of parabolic waveform that modulates video signal at field rate to compensate for non scene-dependent signals generated at camera
	MOD BIAS	R17	Adjusts bias on shading modulator at video processor board
	BLK LVL SET	R59	Selects black or no-modulation level for video signal being modulated with shading signals

Unless otherwise stated in the procedure the internal adjustments must be made with the camera control and its related 6000 Series Camera connected together with the cable used in normal operation or with one of the same type and length. For observation purposes a TV monitor in good working condition and having a scanning pattern identical to that of the camera should be connected to one of the VIDEO output terminals at the rear of the camera control.

The adjustment procedures are outlined in Paragraphs 4-10 through 4-19. These procedures are based on the assumption (1) that composite sync and blanking pulses as specified under "Input Signal Requirements" in Table 1-1, are being supplied to the circuits in the camera control, either from an internal generator or from some external source, and (2) that the equipment has been allowed to warm up at least 30 minutes after turn on of ac power.

The adjustment procedures are presented in a particular order to ensure optimum system performance. Individual adjustments may be made out of sequence provided the system is not far out of adjustment otherwise.

4-10. POWER SUPPLY ADJUSTMENTS

- a. Connect power cord at rear of the camera control (POWER connector, Figure 2-1) to a 115 volt (or 230 volt) 60 Hz power source (see Paragraph 2-7); set PWR switch on front panel (Figure 4-1) to OFF;
- b. Put the power supply plug-in board on the board extender as in Figure 4-10; set PWR switch to ON; using terminal 1 or 18 (Figure 4-6) for the ground

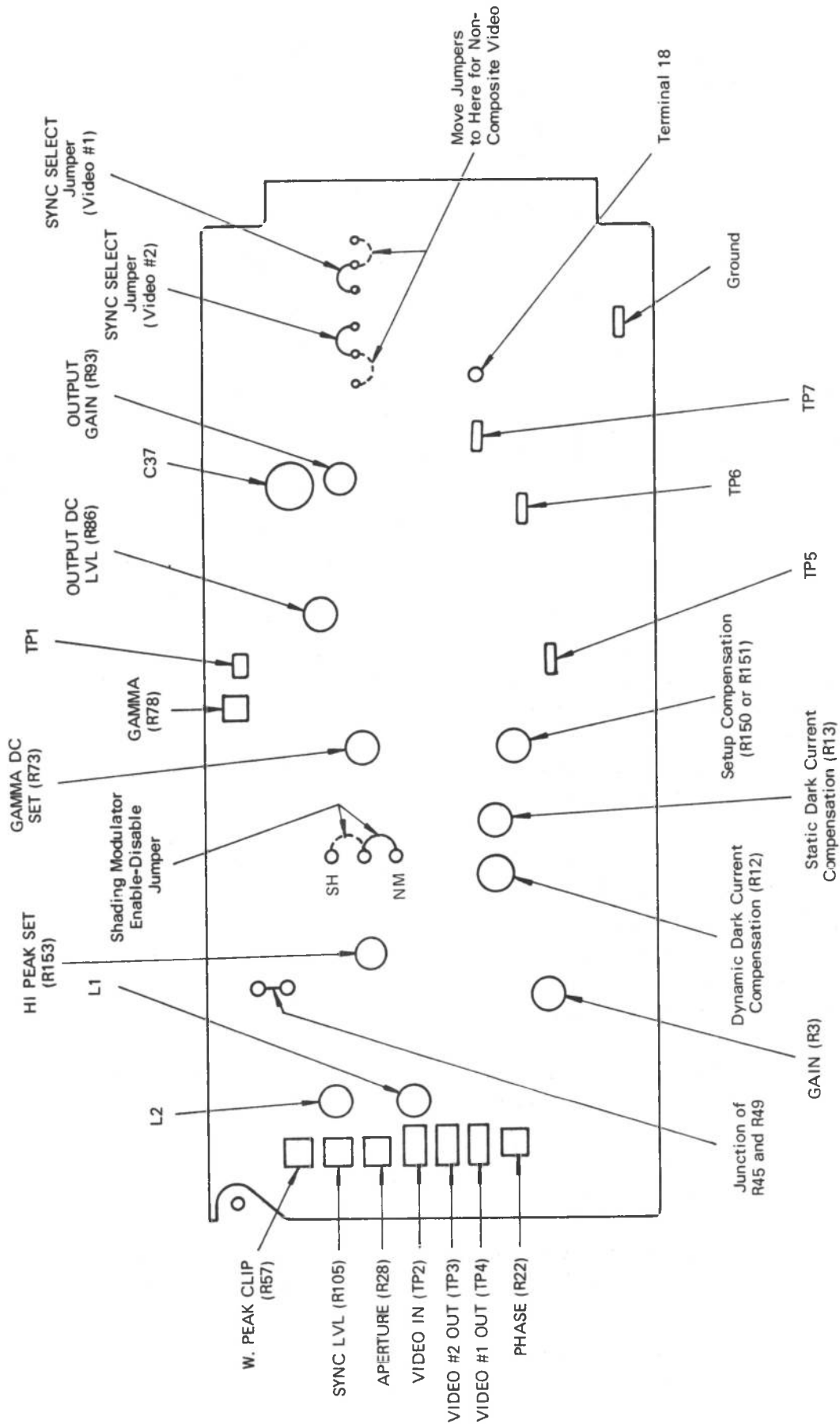


Figure 4-5. Video Board Adjustable Components and Test Points

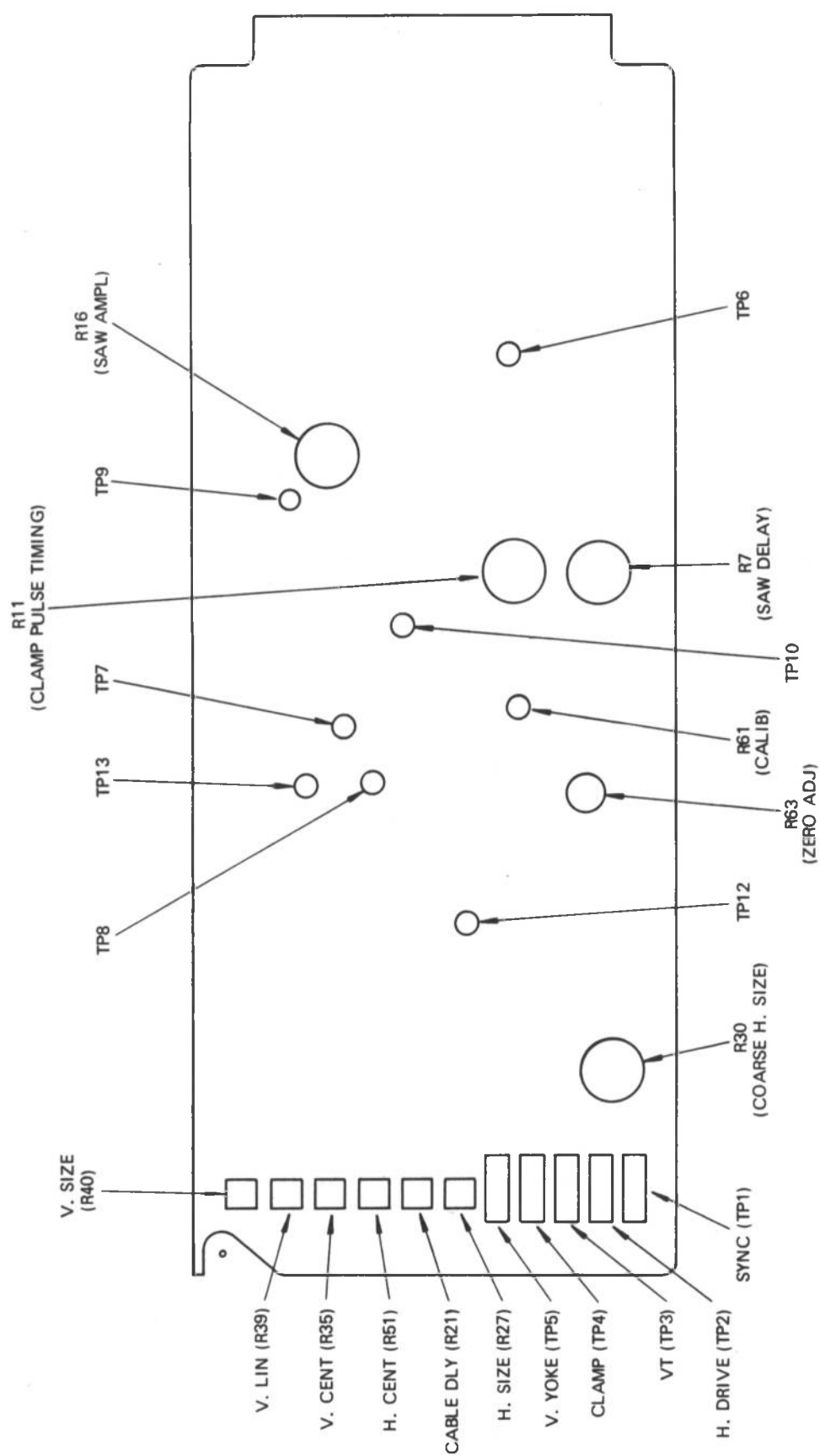


Figure 4-6. Deflection Board 8455801 Test Points and Adjustable Controls (S/N 8-0001 and ON)

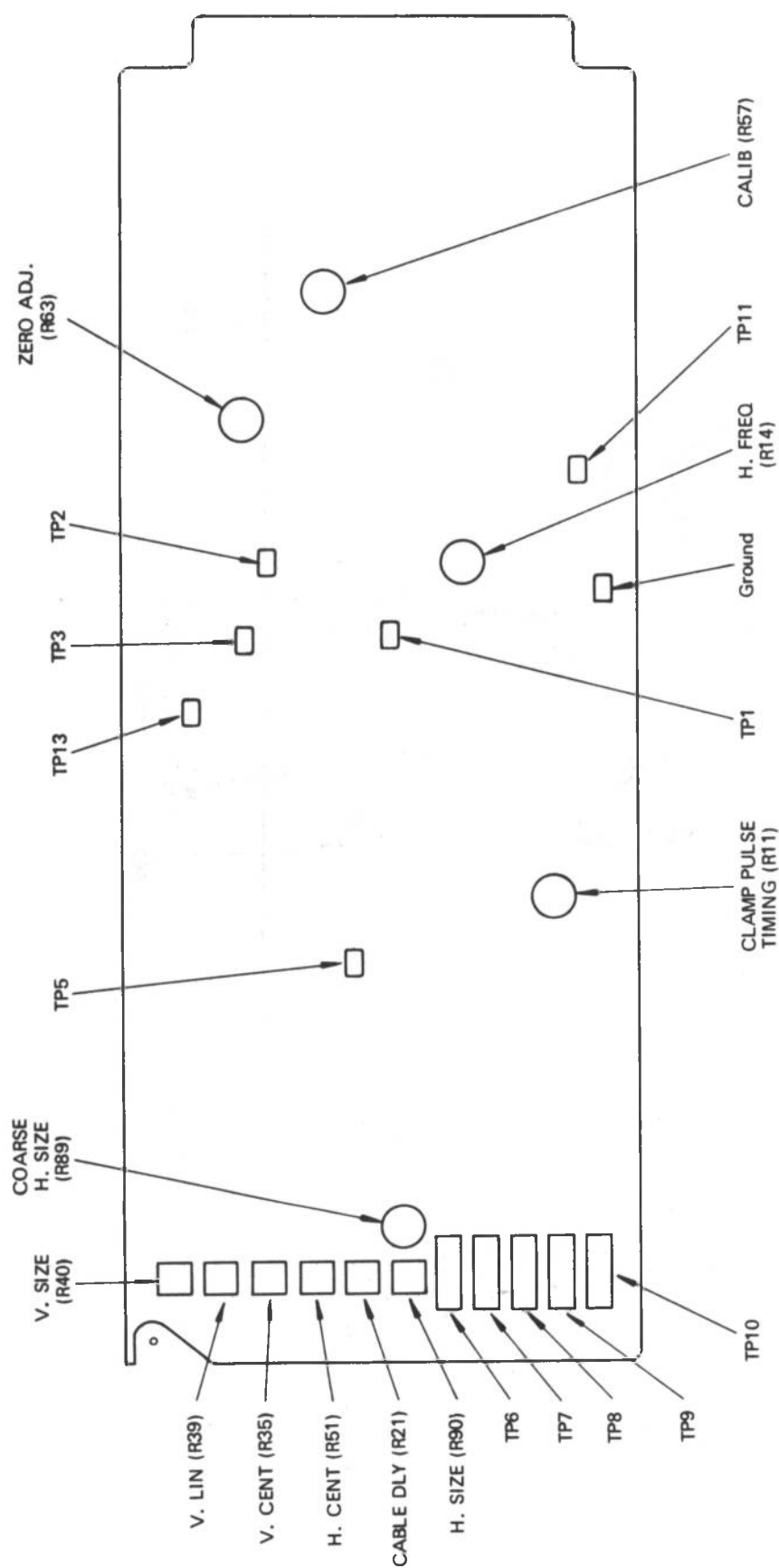


Figure 4-7. Deflection Board 8455901 Test Points and Adjustable Controls (S/N 9-0001 and ON)

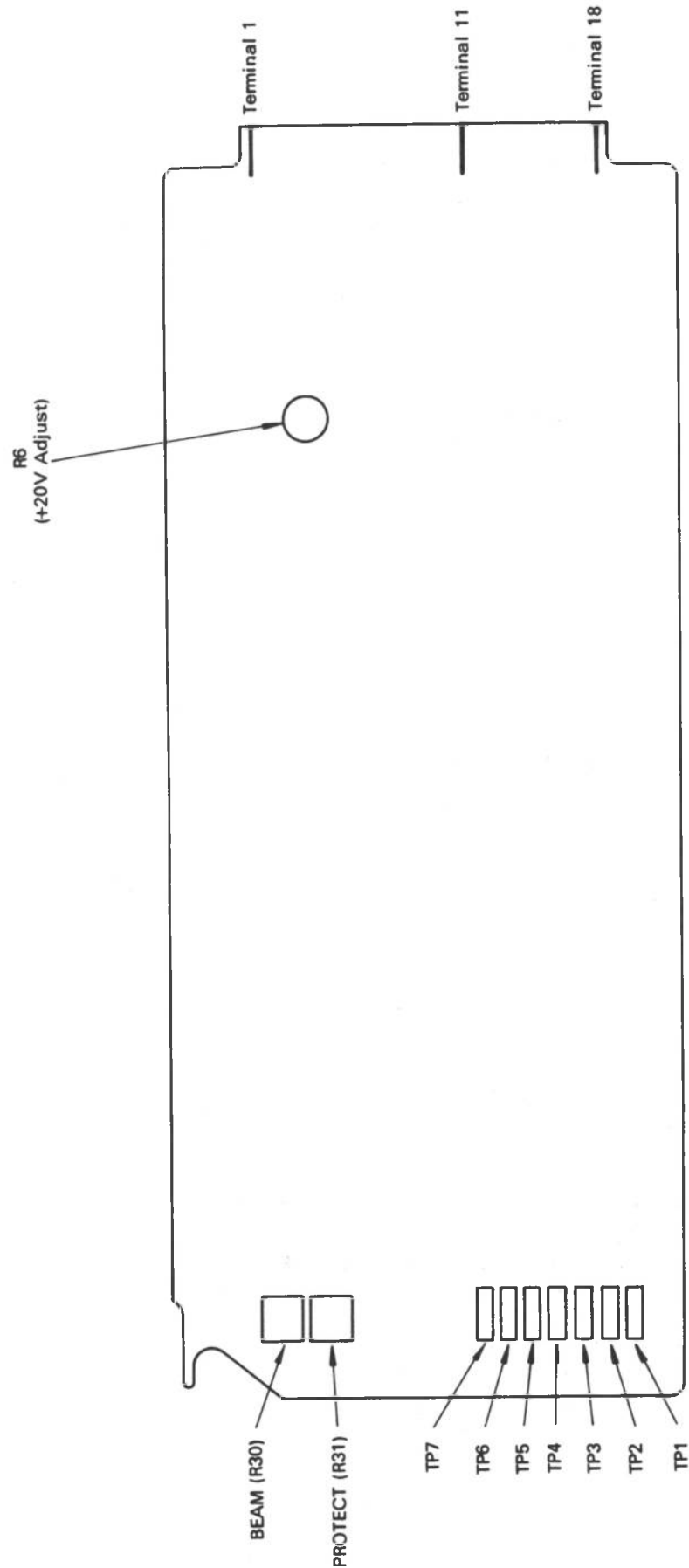


Figure 4-8. Power Supply Board Test Points and Adjustable Controls

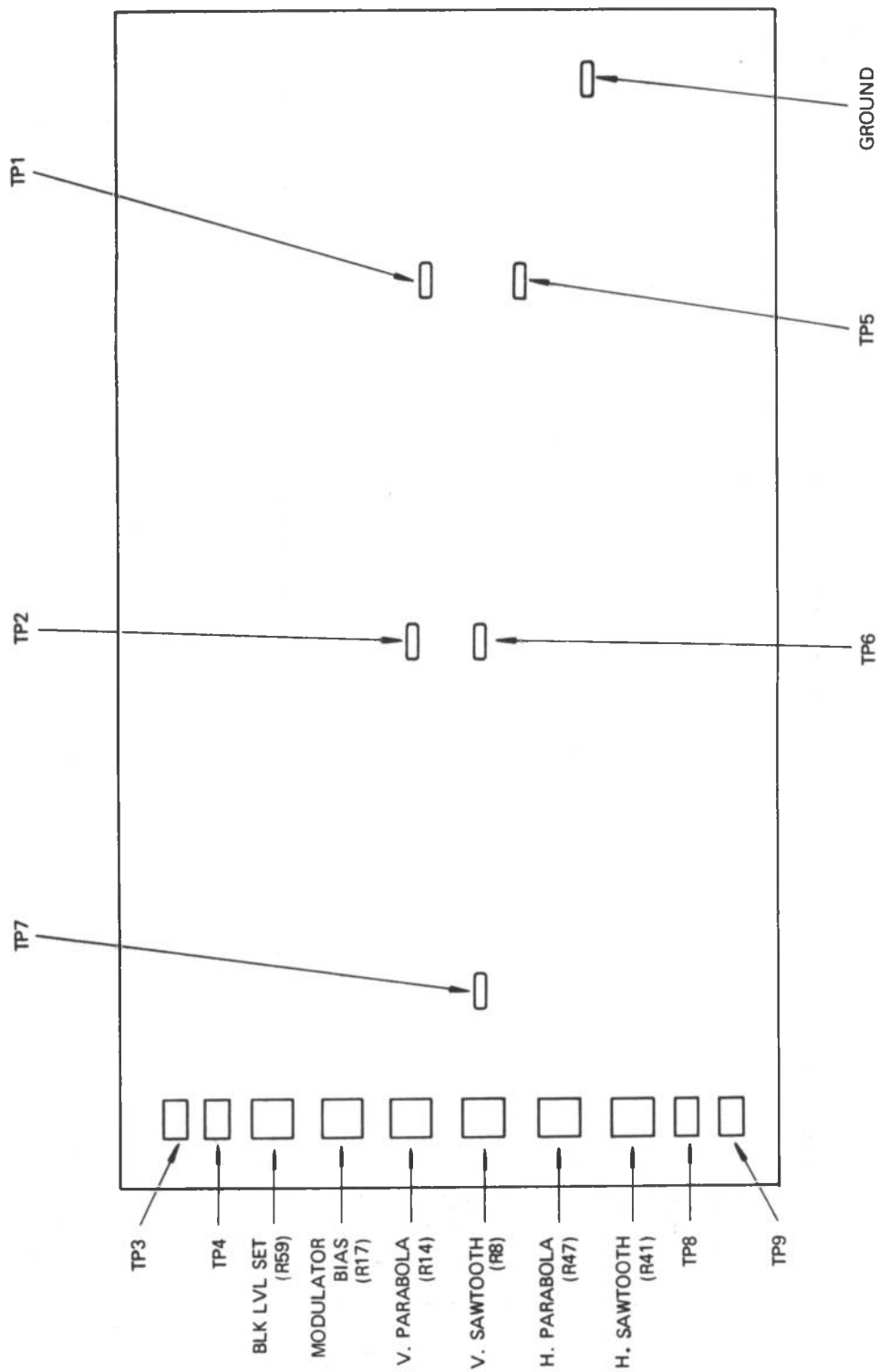


Figure 4-9. Shading Board Adjustments and Test Points

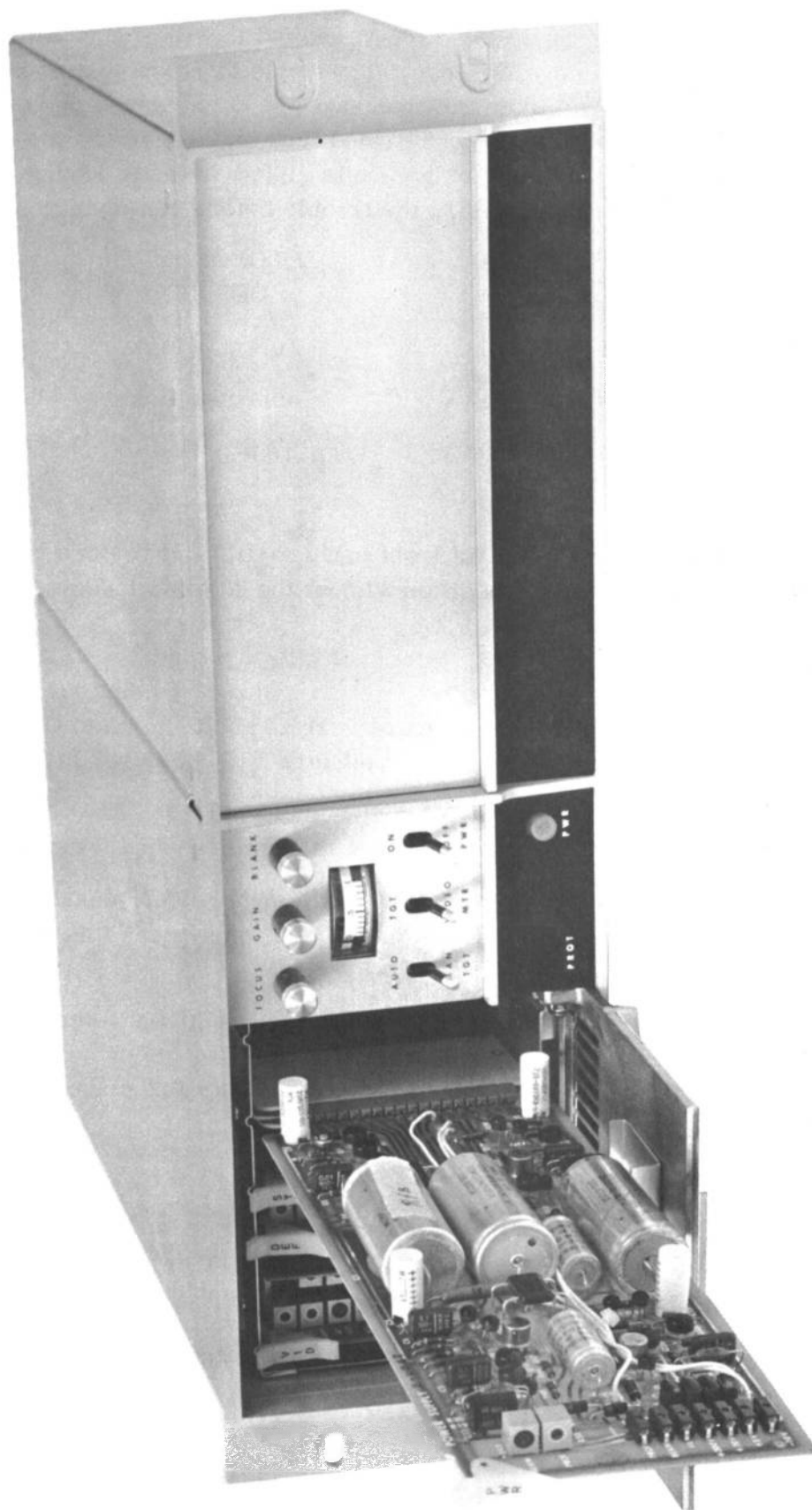


Figure 4-10. Power Supply Installed on Extender Board for Testing

return, measure, with an accurate dc voltmeter (Paragraph 4-2), the dc voltage at TP3; if other than $+20V \pm 20mV$, adjust to within this tolerance with R6; check, using an oscilloscope, that ripple or noise content at TP3 does not exceed 5mV p-p; likewise, measure the dc voltages and noise or ripple content levels at TP1, TP2, TP7 and terminal 11; if any voltage or ripple measurement is not within the limits listed in the following table, repair the voltage regulator causing the trouble before continuing;

TEST POINT	VOLTAGE LIMITS	NOISE OR RIPPLE CONTENT
TP-1	-9.7 to -10.3 V	5mV p-p Max.
TP-2	+4.9 to +5.2 V	5mV p-p Max.
TP-7	+285 to +330 V	2V p-p Max.
Terminal 11	-95 to -110 V	-----

- c. Set PWR switch on camera control front panel to OFF and restore the power supply board to its normal position without the board extender.

4-11. METER CALIBRATION

- a. At the camera control front panel (Figure 4-1) set PWR switch to ON, MTR switch to TGT, TGT switch to MAN, and turn GAIN control fully CCW;
- b. At the deflection board (Figures 4-1 and 4-6 or 4-7) set ZERO ADJ control R63 so the meter on the front panel of the camera control reads zero;
- c. Using a dc voltmeter for measurement, adjust the GAIN control on the camera control front panel for a reading of +20 volts at TP7 on the video processor board (Figures 4-1 and 4-5);
- d. Adjust CALIB control R57 on the deflection board (Figure 4-6 or 4-7) so the target voltage meter reading on the front panel of the camera control coincides as nearly as possible with the voltage reading made at TP7 in preceding step.

NOTE

The front-panel meter reads direct up to 100 volts full scale for target voltage measurements and is calibrated in divisions of 10 volts. The meter reads video p-p voltage (less sync) $\times 0.5$ up to 2 volts FS and is calibrated in divisions of 0.2 volts.

4-12. PROTECTION THRESHOLD ADJUSTMENT

- a. Set PWR switch on camera control front panel to ON;

- b. Adjust PROT control R31 on end of power supply board (Figure 4-8) to the point where the PROT lamp on camera control front panel just becomes energized; now adjust R31 in the opposite direction to the point where the PROT lamp just becomes extinguished.

NOTE

Unplugging the deflection board (Figure 4-1) from its socket in the camera control should now cause the PROT lamp to become energized.

4-13. DEFLECTION ADJUSTMENTS

- a. Install camera on a Cohu test jig (see camera instruction manual for exact type) facing a 1600-line resolution test chart. If such a test jig is unavailable, remove the resolution test chart from the back of this manual and hang it on a wall; position the camera so the optical axis of the lens is perpendicular to and centered on the chart. The proper distance from the plane of the chart to the center of the lens depends on focal length of the lens, as indicated in the following table:

*FOCAL LENGTH	LENS-TO-CHART DISTANCE
1/2"	13"
1"	26"
2"	52"
3"	78"
4"	104"
6"	156"
9"	234"
12"	312"

*The focal length of some lenses may vary several percent from the labeled value. Also, the correct distance to use from lens to chart will depend somewhat on the thickness of the lens, and some lenses may not focus ideally at distances as close as specified in this chart. Also any aberrations in the lens will be magnified. This is especially true of lenses with a short focal length. Therefore, if geometric distortion or resolution, particularly corner resolution for large lens apertures, is unsatisfactory, the lens may be a contributing factor.

- b. Put camera into operation as in Paragraph 2-8 or 2-9;
- c. If the deflection board in the camera control is a type 8455801:
 1. Set SAW DELAY control R7 (Figure 4-6) so the leading edge of the

negative pulse at TP6 (Figure 4-6) lags the trailing edge of the first serration in vertical sync in composite sync signal at TP1 by 2 microseconds, as in Figure 4-11;

2. Set SAW AMPL control R16 (Figure 4-6) so the peak-to-peak amplitude of the sawtooth waveform at TP9 (Figure 4-6) is 1.5 volts;
 3. Set CABLE DELAY control R21 (Figure 4-6) so horizontal retrace in video signal at TP2 on end of video board (Figure 4-5) starts just after the leading edge of horizontal blanking in composite blanking signal at either BLANK IN or BLANK OUT connector on camera control rear panel (Figure 4-4);
 4. Set CLAMP PULSE TIMING control R11 (Figure 4-6) to eliminate any horizontal white streaks in picture on monitor raster; if this does not completely eliminate all streaks also readjust CABLE DELAY control R21 (Figure 4-6);
 5. Using H. SIZE, COARSE H. SIZE, H. CENT, VERT CENT and VERT SIZE controls (R27, R30, R51, R35, R40, Figure 4-6), frame resolution test pattern on monitor screen so the points of the arrows along the edges of the test pattern just touch or slightly overlap the edges of the monitor raster;
- d. If the deflection board in the camera control is a type 8455901:
1. Set R14 (Figure 4-7) so the negative pulse at TP1 (Figure 4-7) starts 6 microseconds before the leading edge of horizontal blanking in composite blanking signal at either BLANK IN or BLANK OUT connector on rear panel (Figure 4-4);
 2. Set CABLE DELAY control R21 (Figure 4-7) so horizontal retrace in video signal at TP2 on end of video board (Figure 4-5) starts just after the leading edge of horizontal blanking in the composite blanking signal at either BLANK IN or BLANK OUT connector on camera control rear panel (Figure 4-4);
 3. Set CLAMP PULSE TIMING control R11 (Figure 4-7) so all horizontal white streaks are eliminated from picture at monitor;
 4. Using H. SIZE, COARSE H. SIZE, H. CENT, VERT CENT and VERT SIZE controls (R90, R89, R51, R35, R40, Figure 4-7), frame resolution test pattern on monitor raster so the points of the arrows along the edges of the test pattern just touch or slightly overlap the edges of the raster.

4-14. SCAN LINEARITY ADJUSTMENTS

- a. Install camera on a test jig, as in Paragraph 4-13, steps a and b, but replace resolution test pattern with a RETMA Linearity Chart; if such a chart is unavailable use the linearity chart provided at the back of this manual;

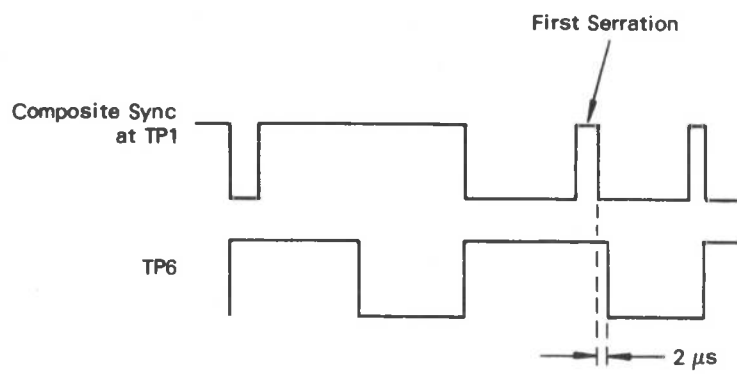


Figure 4-11. TP6 Waveform Timing at Deflection Board 8455801

- b. Connect video input cable from a dot-bar generator (Cohu DBG-2, or equivalent) to the VIDEO OUT connector at rear of camera control (Figure 4-4), and connect video output cable from the dot-bar generator to the video input connector at the TV monitor;
- c. Adjust the controls on the dot-bar generator so 14 rows and 17 columns of dots are displayed at the TV monitor; center the dot pattern accurately on the monitor raster with the appropriate controls on the dot-bar generator;
- d. If all of the dots generated by the dot-bar generator are not within or touching the corresponding black circles on the RETMA Linearity Test Pattern, correct by adjusting the VERT LIN, H. SIZE and VERT SIZE controls (R39, R27 and R40, Figure 4-6 or R39, R90 and R40, Figure 4-7) on deflection board in camera control and the HORIZONTAL LINEARITY control at the camera; if all of the dots are within the circles the camera scan linearity is within $\pm 1\%$; if any of the dots touches a circle the linearity is within 2% ; if any of the dots is outside its circle the linearity is $\pm 3\%$ or greater.

4-15. VIDEO GAIN AND BANDWIDTH ADJUSTMENTS

- a. Remove lens from camera and replace with a Cohu simulator (see Section IV in the camera instruction manual for directions); connect output of a sweep frequency generator (Paragraph 4-2) to input of simulator, and check that video gain and bandwidth of video amplifier in camera are correct (see procedure in Section IV of the camera instruction manual);

NOTE

The response of the video amplifier in camera should deviate no more than ± 0.5 dB up to 32 MHz, and video signal at camera output terminal should have a peak-to-peak amplitude of 200 millivolts.

- b. At camera control: (1) put shading modulator enable-disable jumper on video processor board (Figure 4-5) to NM position; (2) set PWR switch on front panel to ON, GAIN control to midpoint, TGT switch to MAN;
- c. With camera still set up for test as in step a, monitor sweep frequency signal at junction of R45 and R49 (Figure 4-5) on video processor board using an oscilloscope with a low-capacity X10 attenuator probe (Paragraph 4-2); set R3 (Figure 4-5) so amplitude of sweep signal at this junction is 2 volts peak-to-peak; set dc blanking level in same signal to +0.4 volt with BLANK control on camera control front panel; adjust L2 (Figure 4-5) for flattest sweep signal response possible up to high end of video bandpass (8 MHz, 16 MHz or 32 MHz); set APERTURE control R28 (Figure 4-5) to midpoint; adjust L1 (Figure 4-5) for a peak in sweep signal at 6 MHz in 8 MHz systems, or at 14 MHz in 16 MHz systems, or at 30 MHz in 32 MHz bandwidth systems; set APERTURE control R28 fully CCW;

- d. Move oscilloscope test probe to VIDEO output connector J3 or J4 on camera control rear panel (Figure 4-4); ensure that both VIDEO connectors are terminated into 75-ohm loads (one of the loads must be a TV monitor);
- e. Set dc level of sweep signal at J3 or J4 at zero volt average dc level with OUTPUT DC LEVEL control R86 (Figure 4-5); turn W. PEAK CLIP control R57 fully CCW and set sweep signal amplitude at 750 millivolts with OUTPUT GAIN control R93; adjust signal for flattest response possible out to high-frequency end of video bandpass (8 MHz, 16 MHz or 32 MHz) with C37; readjust OUTPUT DC LEVEL control R86, if necessary, to keep the average dc level of signal at zero volts;
- f. At camera, disconnect sweep-frequency generator, remove vidicon simulator, reinstall lens and restore camera to normal operation; install camera on test jig with 1600-line resolution test pattern, as in step a of Paragraph 4-13;
- g. At camera control front panel, set PWR switch ON, set TGT switch to MAN, and adjust GAIN control and/or lens iris at camera so video amplitude (not including sync but including blanking) at TP3 or TP4 on video board is 0.714 volt peak-to-peak (see Figure 4-12); readjust BLANK control, if necessary, for 70mV setup;
- h. Check that both SYNC-SELECT jumpers (Figure 4-5) on video processor board (see Paragraph 2-5) are installed at COMP positions so composite video will be supplied at both VIDEO output terminals at rear of camera control (Figure 4-4); set amplitude of sync in composite video signal at TP3 or TP4 on video processor board at 0.286 volt (see Figure 4-12) with SYNC LEVEL control R105 on same board (the peak-to-peak amplitude of composite video at these test points should be one volt);
- i. Adjust setup in video signal at TP3 or TP4 to .07 volt (see Figure 4-12) with BLANK control on front of camera control;
- j. With camera still focused on 1600 line resolution test pattern, observe sharp horizontal transitions from black to white and white to black in picture at monitor and adjust PHASE control R22 (Figure 4-5) to eliminate any white fringes that trail or precede these transitions;

NOTE

Ignore the next two steps unless the image tube in the camera is a vidicon.

- k. Cap the lens at the camera; at camera control front panel set TGT switch to MAN and turn GAIN control clockwise as far as it will go; note setting of BEAM control R30 (Figure 4-8) on end of power supply board (Figure 4-1) and increase beam current by turning the control CW; monitor video signal at TP3 or TP4 on end of video processor board (Figure 4-5) and adjust setup (Figure 4-12) in signal to 70 millivolts with BLANK control on

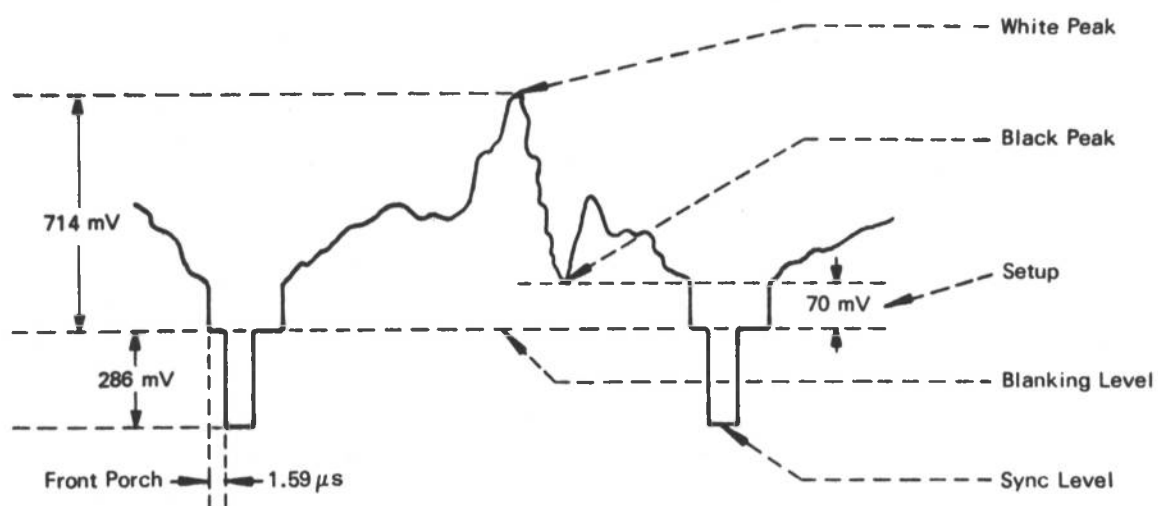


Figure 4-12. Composite Video Output Signal Parameters

camera control front panel; adjust static dark current compensation control R13 (Figure 4-5) on video processor board for minimum change in this set-up as GAIN control on the camera control front panel is adjusted through its full range; restore BEAM control at power supply board to original setting;

NOTE

Perform the adjustments in the next two steps (l and m) only if the video processor board has serial number 1-0026 or higher.

1. While camera is set up on test jig with the resolution test pattern, turn TGT switch on camera control front panel to AUTO and adjust BLANK control on same panel for best picture at the TV monitor; observe with an oscilloscope the video waveform at TP3 or TP4 (Figure 4-5) on the video processor board and adjust dynamic black level compensation control R12 to eliminate as much as possible the occurrence of any change in blanking level in video signal as the lens on the camera is abruptly capped or uncapped;

NOTE

Perform next step only if the system is used to provide a reversed polarity (negative-white) video output signal.

- m. Monitor video output signal with an oscilloscope probe at TP3 or TP4 on video processor board (Figure 4-5); alternately select negative-white and positive-white video for output with optionally wired-in polarity-select switch or by applying and then removing -10 volts dc from terminal 116 on video processor board; the video signal at TP3 or TP4 should reverse in polarity accordingly and hold the same signal and setup levels (see Figure 4-12) for both polarities; if not, adjust levels in negative-white video with R150 or R151 (Figure 4-5) so such a condition exists.

4-16. APERTURE CORRECTION

The amount of aperture correction to use will vary with customer requirements. Usually, the greater the amount of correction the better the resolution of fine details in the picture. However, the specified limiting resolutions are achieved with no aperture correction and any increase in resolution brought about by such correction results in a proportionate decrease in the signal-to-noise ratio. When aperture correction is desired the settings arrived at in the following procedure will usually suffice:

- a. Put camera into operation and focus it on a 1600-line resolution test pattern, as in steps a and b of Paragraph 4-13;

- b. While observing results at TV monitor, adjust APERTURE control R28 on end of video processor board (Figure 4-5) for desired resolution of tapered lines in vertical wedges at center and corners of test pattern; if the desired resolution introduces objectionable snow into the picture, back off the control setting to the point where the snow just disappears or is at an acceptable level.

4-17. WHITE PEAK CLIP ADJUSTMENT

Unless otherwise requested by the customer at time of purchase, the equipment is adjusted at the factory so no white peak clipping of the video signal will occur within the specified range of adjustment of video output level. However, if the majority of scenes to be televised has a high incidence of specular highlights, some white peak clipping may be desirable. To adjust for this:

- a. Put camera into operation and focus on any reasonably well lighted scene;
- b. Monitor video signal at TP3 or TP4 on video processor board (Figure 4-5) with an oscilloscope, set TGT switch on camera control front panel to MAN, and adjust video amplitude and blanking levels to those shown in Figure 4-12 with the GAIN and BLANK controls on the same front panel; now turn GAIN control clockwise to make video signal amplitude about 40% greater than normal and adjust W. PEAK CLIP control R57 (Figure 4-5) so video signal clips on white peaks that are 20% greater in amplitude than normal.

NOTE

The white peak clipping level used in preceding step was arbitrarily selected. Some applications may require other clipping levels.

4-18. GAMMA CORRECTION

Gamma correction compensates primarily for non-linear response to light of the image tube in the camera and the picture tube at the television receiver. For most purposes the gamma selected with the following procedure will accomplish the desired results:

- a. Put camera into operation and focus it on a 1600 line resolution test pattern, as in Paragraph 4-13, steps a and b;
- b. While observing results at the TV monitor, adjust GAMMA control R78 on video processor board (Figure 4-5) for most uniform gradation of the ten gray shades in the four gray scales inside white circle on test pattern.

4-19. SHADING ADJUSTMENTS

NOTE

Shading adjustments are applicable only if the camera control contains the optional shading board (Figures 4-1 and 4-9).

- a. At video processor board (Figure 4-5) put shading modulator enable-disable jumper in the NM position;
- b. Put camera into operation as in steps a and b of Paragraph 4-13, but replace resolution test pattern with a RETMA Linearity Test Pattern;
- c. Monitor video signal at TP3 or TP4 on the video processor board with an oscilloscope; at camera control front panel set TGT switch to MAN and adjust GAIN and BLANK controls so setup and video amplitude at TP3 or TP4 are normal, as in Figure 4-12;
- d. Set R17 on the shading board to mechanical mid-range;
- e. Move oscilloscope probe to TP3 on shading board and null out all shading waveforms with R8, R14, R41 and R47;
- f. Move oscilloscope probe to TP8 on shading board and note video and blanking levels;
- g. Move shading modulator enable-disable jumper on video processor board to the SH position; adjust MODULATOR BIAS control R17 (Figure 4-9) so setup and video amplitude at TP8 is the same as noted in the preceding step;

NOTE

To achieve this, it may be necessary to re-adjust the BLANK control on the camera control front panel.

- h. Move oscilloscope probe to video output test point TP3 or TP4 on video processor board, and adjust BLK LVL SET control R59 on shading board for minimum modulation of the black level in the video signal as V. PARABOLA potentiometer R14 is adjusted through its full range;

NOTE

After R59 has been adjusted it may be necessary to readjust the BLANK control on camera control front panel to correct setup in video signal.

- i. Synchronize time base of oscilloscope to horizontal scan rate of camera; adjust H. SAWTOOTH control R41 and H. PARABOLA control R47 on shading board so white edge of video signal is as flat as possible;

- j. Synchronize time base of oscilloscope to field rate of camera; adjust V. SAWTOOTH control R8 and V. PARABOLA control R14 on shading board so white edge of video signal is as flat as possible.

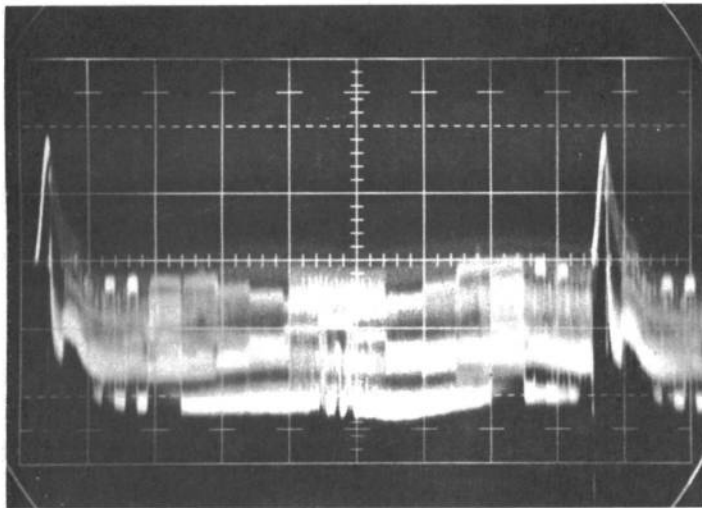
4-20. CORRECTIVE MAINTENANCE

Familiarity with the circuits in the camera control is recommended before any troubleshooting is attempted. The circuits are described in Section III. If a malfunction occurs and the cause of the trouble is not immediately apparent, the first step should be to try and isolate the malfunction to the subassembly where it is occurring. Generally, the best approach is to first check for correct dc supply voltages and waveforms on the ends of the plug-in circuit boards. The appropriate dc supply voltages are noted in the schematics at the end of this section. Typical waveforms that should be present at those terminals and at other test points are shown in Figures 4-13 through 4-16. As noted in the illustrations, some of these waveforms were taken in a system with a 525-line scan rate while the others were in a system with a 945-line scan rate. Except for some differences in pulse repetition rates and widths, the waveforms should be similar in systems having other scan rates.

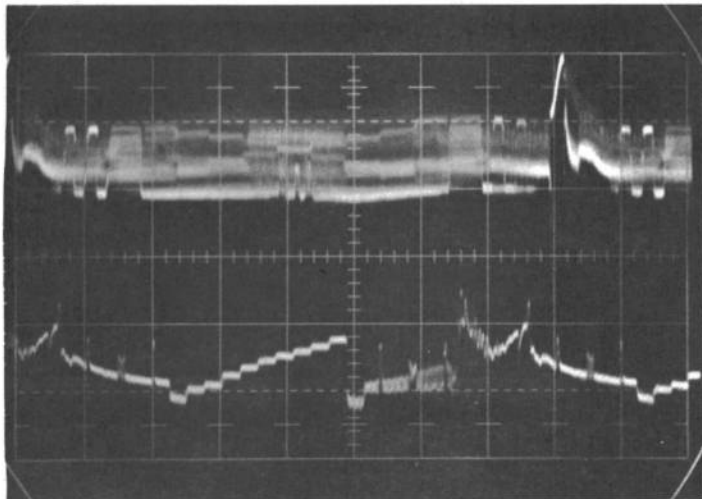
An additional servicing aid in the form of a troubleshooting chart is provided in Table 4-2. This chart lists the most common faults that might arise, indicates the probable cause, and helps to isolate the trouble to the area or point where it is occurring.

When servicing the circuits in the camera control adhere to the following rules:

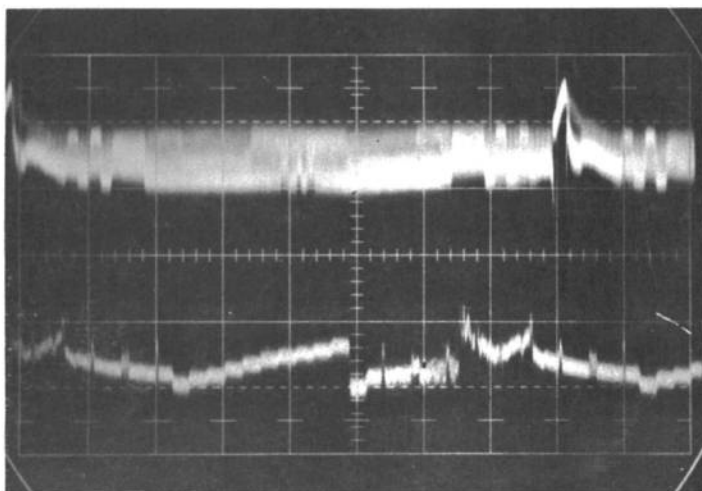
- a. Use care in placing test probes on test points close to other circuits, otherwise damage to semiconductor circuits may result;
- b. Replace defective components with ones known to be in good condition;
- c. Disconnect the equipment from the ac power source before doing any soldering;
- d. Use a well-tinned soldering iron if soldering is necessary;
- e. Avoid overheating etched-circuit paths and semiconductors when soldering; where possible, use a heat sink on semiconductor leads where soldering iron is applied.



TP2: 2ms/cm; 100 mV/cm



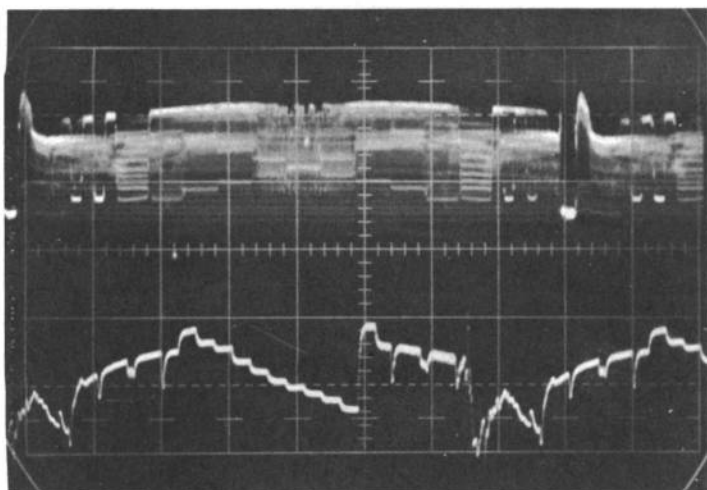
TP2: 2 ms/cm; 200 mV/cm



Terminal 5: 2 ms/cm; 1V/cm

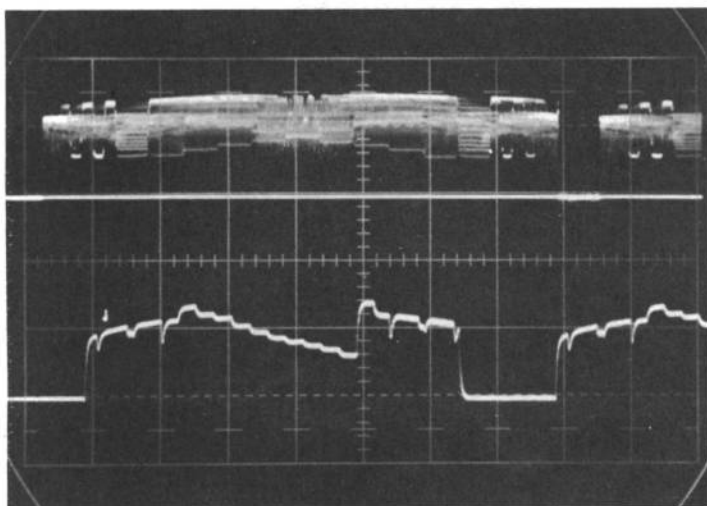
Terminal 5: 5 μ s/cm; 1V/cm

Figure 4-13.
Video Processor Board Waveforms
(945-line scan rate) (Sheet 1 of 3)



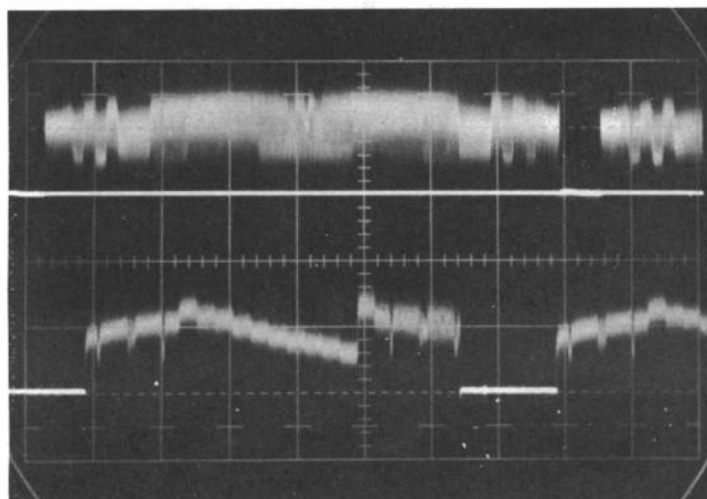
Terminal 17: 2 ms/cm; 1V/cm

Terminal 17: 5 μ s/cm; 1V/cm



Terminal 16: 2 ms/cm; 1V/cm

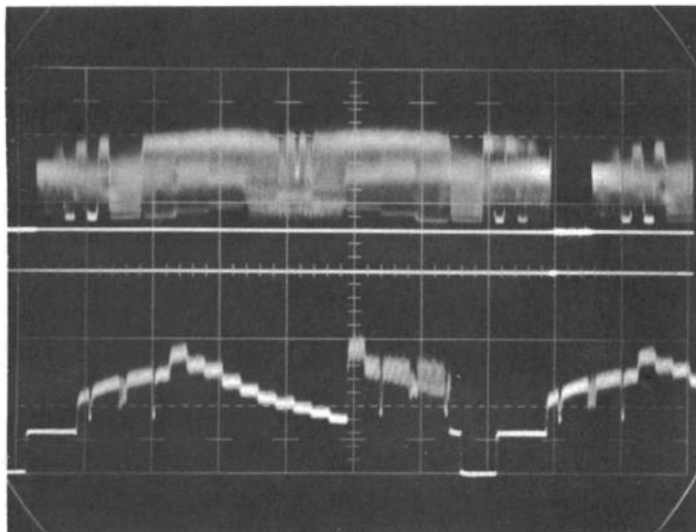
Terminal 16: 5 μ s/cm; 1V/cm



TP1: 2 ms/cm; 0.5V/cm

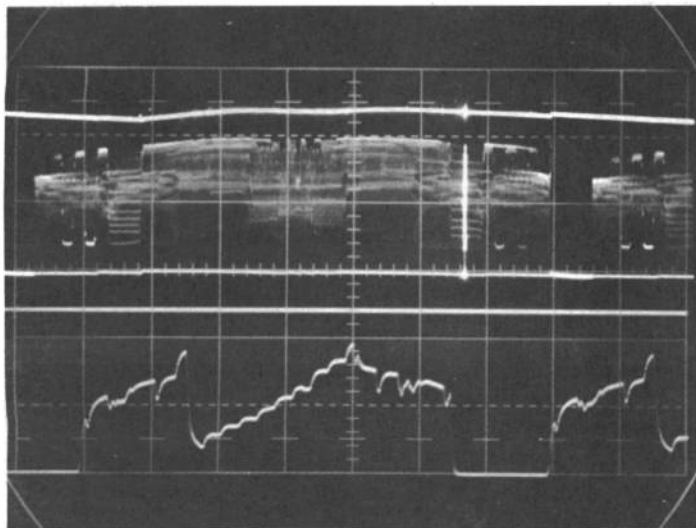
TP1: 5 μ s/cm; 0.5V/cm

Figure 4-13.
Video Processor Board Waveforms
(945-line scan rate) (Sheet 2 of 3)



Terminals 105/107:
2 ms/cm; 0.5 V/cm

Terminals 105/107:
5 μ s/cm; 0.5 V/cm



TP6: 2 ms/cm

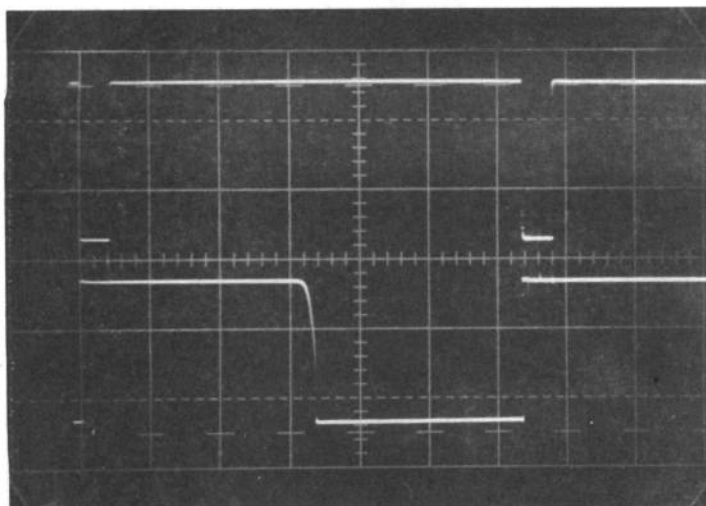
TP5: 2 ms/cm; 5 V/cm

TP6: 5 μ s/cm

TP5: 5 μ s/cm; 5 V/cm

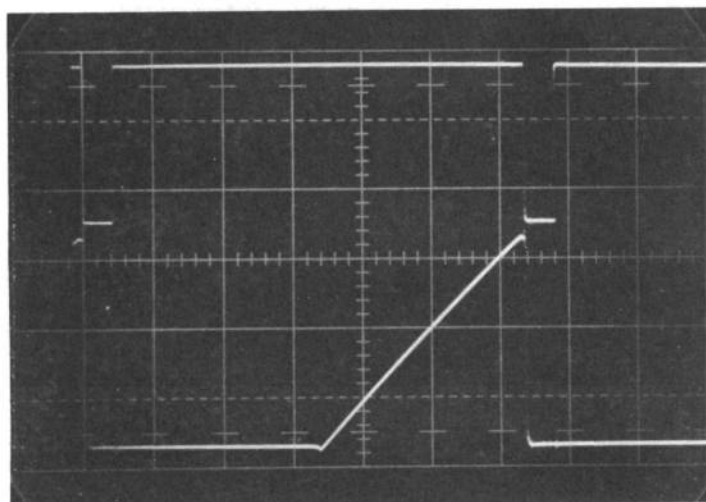
(Auto target signal at TP6 shown in
synchronization with video at TP5)

Figure 4-13.
Video Processor Board Waveforms
(945-line scan rate) (Sheet 3 of 3)



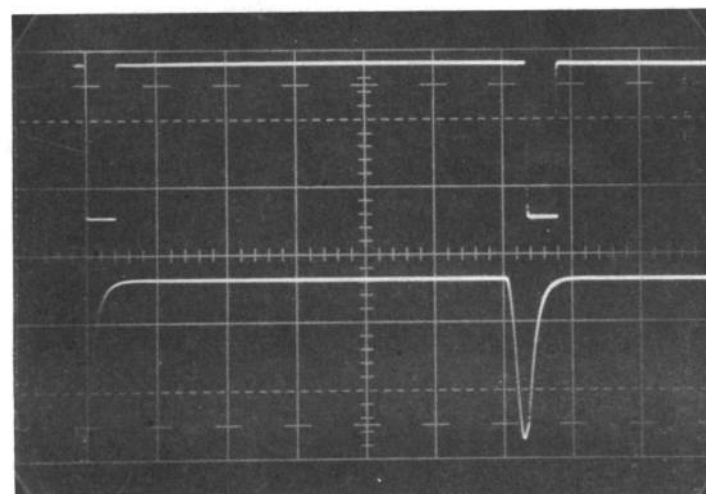
TP1: $10 \mu\text{s}/\text{cm}$; $2\text{V}/\text{cm}$

TP6: $10 \mu\text{s}/\text{cm}$; $1\text{V}/\text{cm}$



TP1: $10 \mu\text{s}/\text{cm}$; $2\text{V}/\text{cm}$

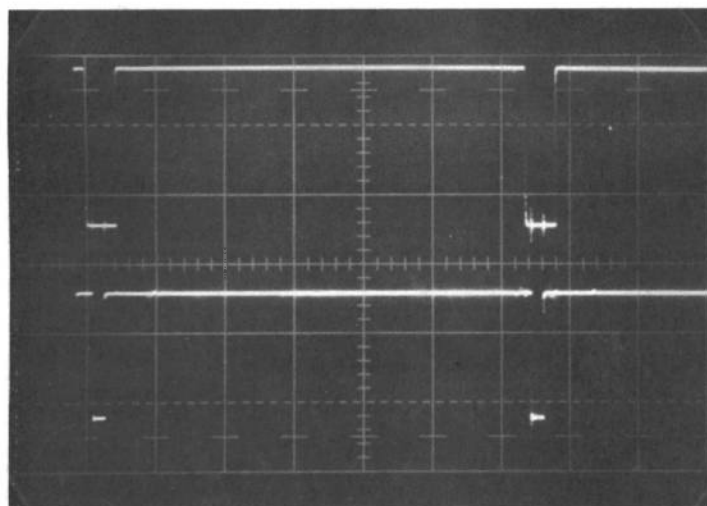
TP9: $10 \mu\text{s}/\text{cm}$; $0.5\text{V}/\text{cm}$



TP1: $10 \mu\text{s}/\text{cm}$; $2\text{V}/\text{cm}$

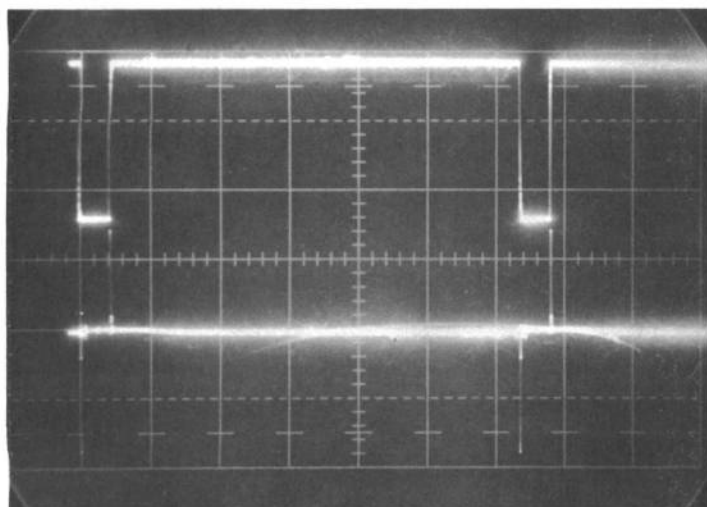
TP4: $10 \mu\text{s}/\text{cm}$; $2\text{V}/\text{cm}$

Figure 4-14.
Deflection Board 8455801 Waveforms
(525-line scan rate) (Sheet 1 of 3)



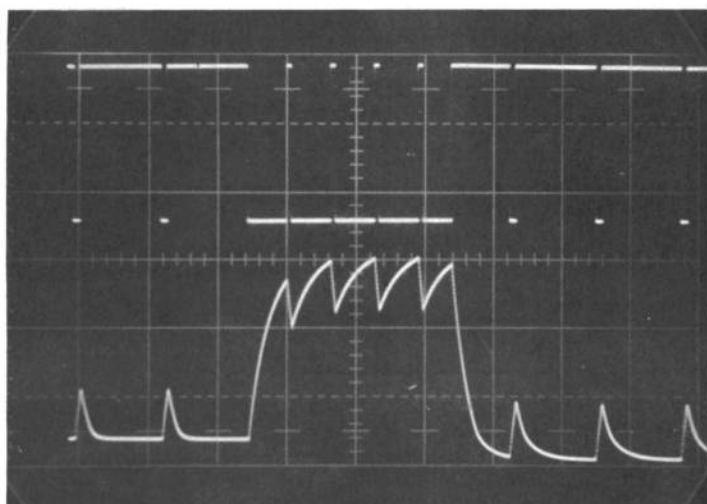
TP1: $10 \mu\text{s}/\text{cm}$; $2\text{V}/\text{cm}$

TP4: $10 \mu\text{s}/\text{cm}$; $2\text{V}/\text{cm}$



TP1: $10 \mu\text{s}/\text{cm}$; $2\text{V}/\text{cm}$

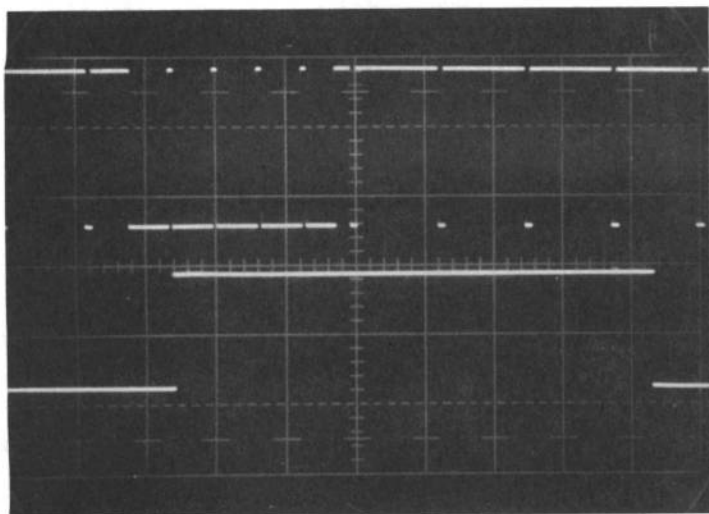
TP7: $10 \mu\text{s}/\text{cm}$; $1\text{V}/\text{cm}$



TP1: $50 \mu\text{s}/\text{cm}$; $2\text{V}/\text{cm}$

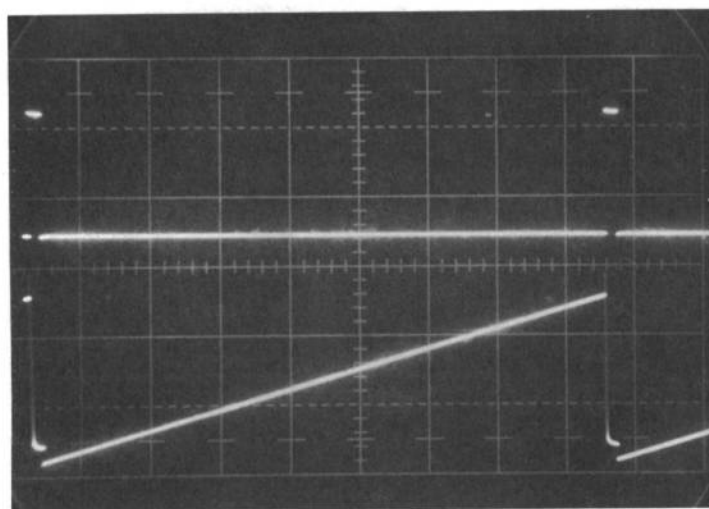
TP8: $5 \mu\text{s}/\text{cm}$; $1\text{V}/\text{cm}$

Figure 4-14.
Deflection Board 8455801 Waveforms
(525-line scan rate) (Sheet 2 of 3)



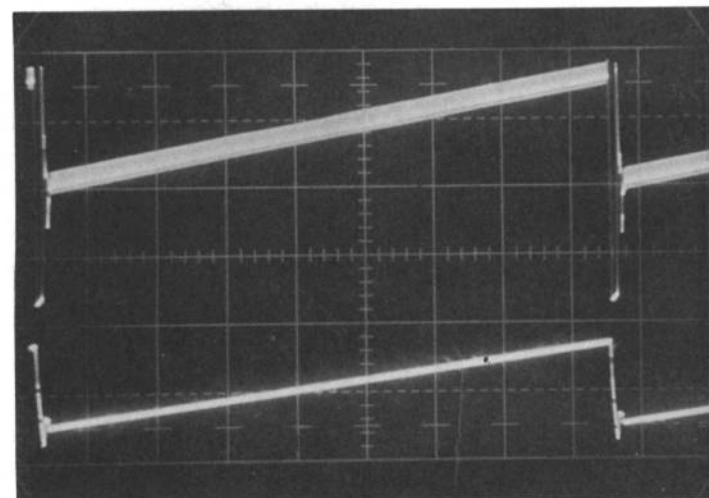
TP1: $50 \mu\text{s}/\text{cm}$; $2\text{V}/\text{cm}$

TP13: $50 \mu\text{s}/\text{cm}$; $2\text{V}/\text{cm}$



TP3: $2 \text{ ms}/\text{cm}$; $2\text{V}/\text{cm}$

TP10: $2 \text{ ms}/\text{cm}$; $1\text{V}/\text{cm}$



TP5: $2 \text{ ms}/\text{cm}$; $5\text{V}/\text{cm}$

TP12: $2 \text{ ms}/\text{cm}$; $2\text{V}/\text{cm}$

Figure 4-14.
Deflection Board 8455801 Waveforms
(525-line scan rate) (Sheet 3 of 3)

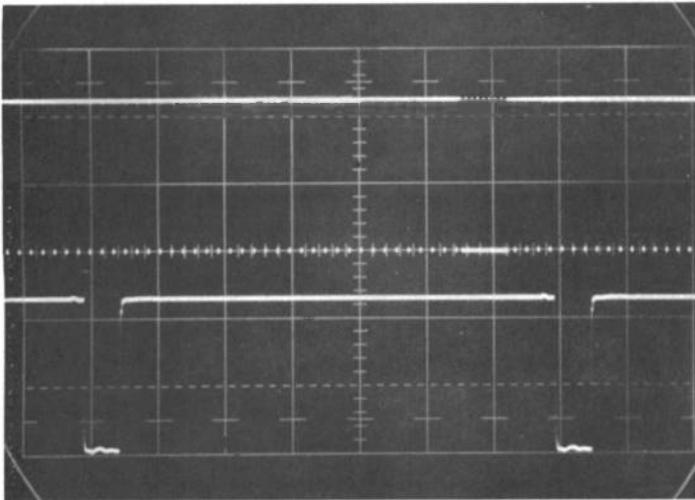
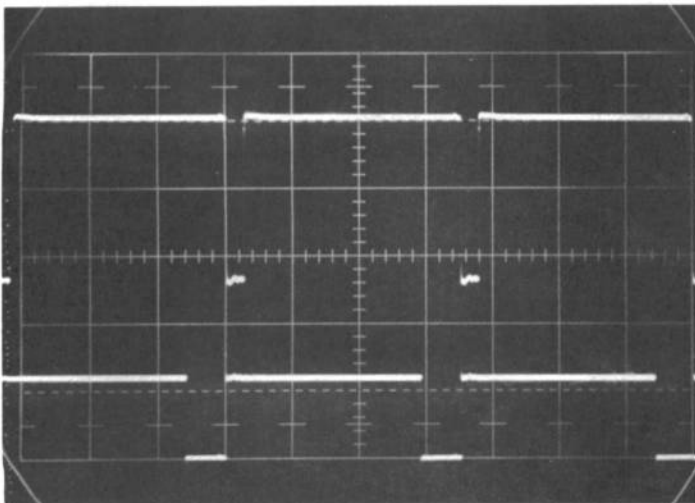
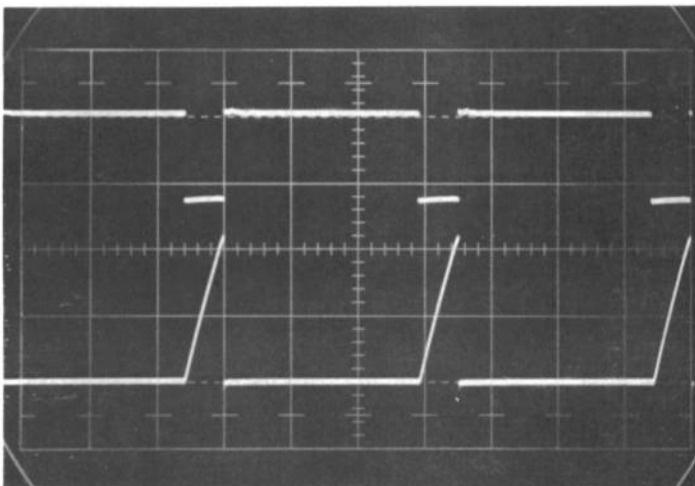
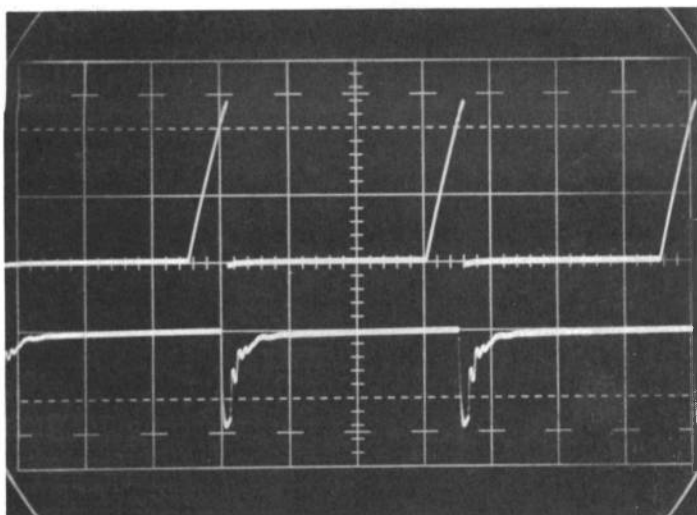
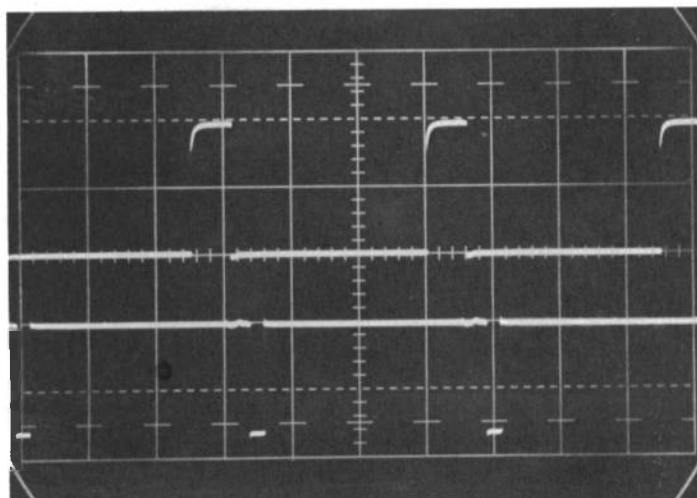
TP9: 200 $\mu\text{s}/\text{cm}$; 2V/cmTP9: 5 $\mu\text{s}/\text{cm}$; 2V/cmTP9: 10 $\mu\text{s}/\text{cm}$; 2V/cmTP1: 10 $\mu\text{s}/\text{cm}$; 2V/cmTP1: 10 $\mu\text{s}/\text{cm}$; 2V/cmTP11: 10 $\mu\text{s}/\text{cm}$; 2V/cm

Figure 4-15.
Deflection Board 8455901 Waveforms
(945-line scan rate) (Sheet 1 of 4)



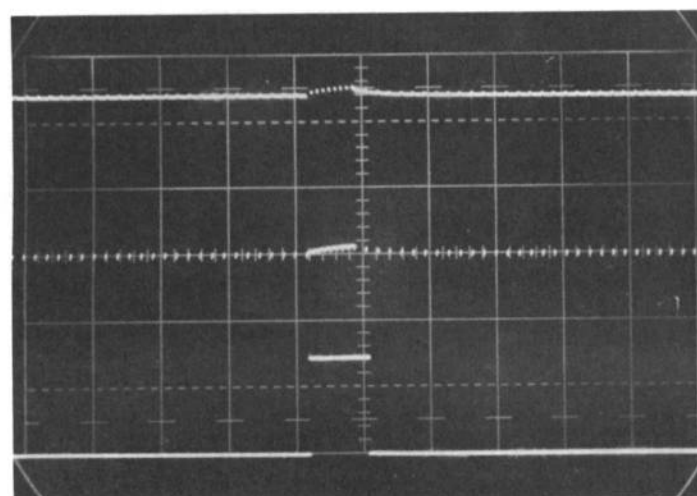
TP11: $10 \mu\text{s}/\text{cm}$; $2\text{V}/\text{cm}$

TP7: $10 \mu\text{s}/\text{cm}$; $2\text{V}/\text{cm}$



U6-1: $10 \mu\text{s}/\text{cm}$; $2\text{V}/\text{cm}$

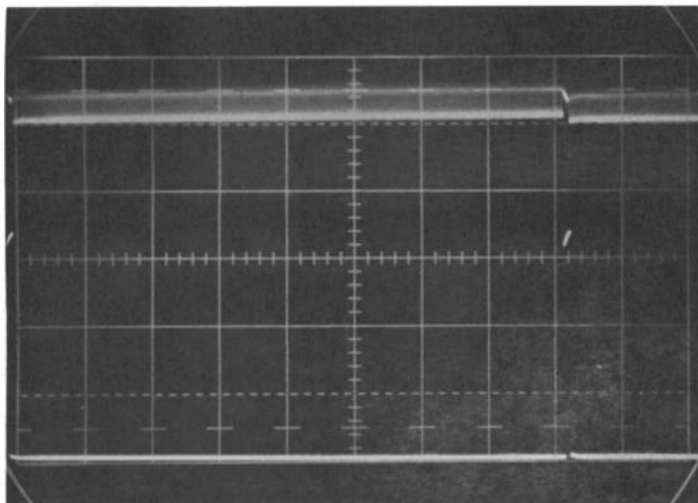
TP10: $10 \mu\text{s}/\text{cm}$; $2\text{V}/\text{cm}$



TP9: $200 \mu\text{s}/\text{cm}$; $2\text{V}/\text{cm}$

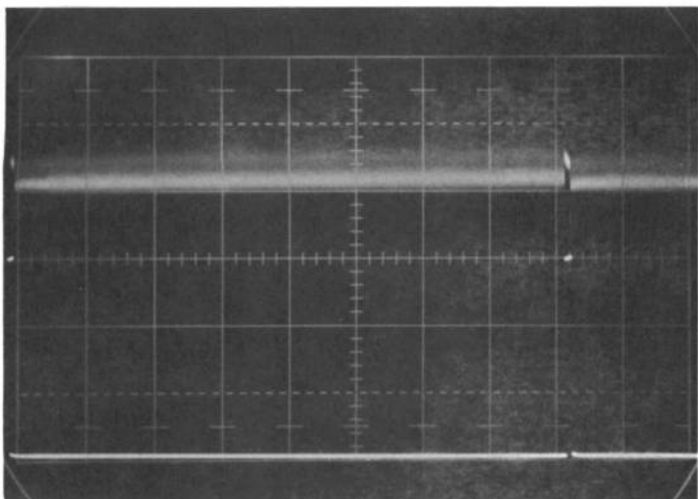
TP13: $200 \mu\text{s}/\text{cm}$; $2\text{V}/\text{cm}$

Figure 4-15.
Deflection Board 8455901 Waveforms
(945-line scan rate) (Sheet 2 of 4)



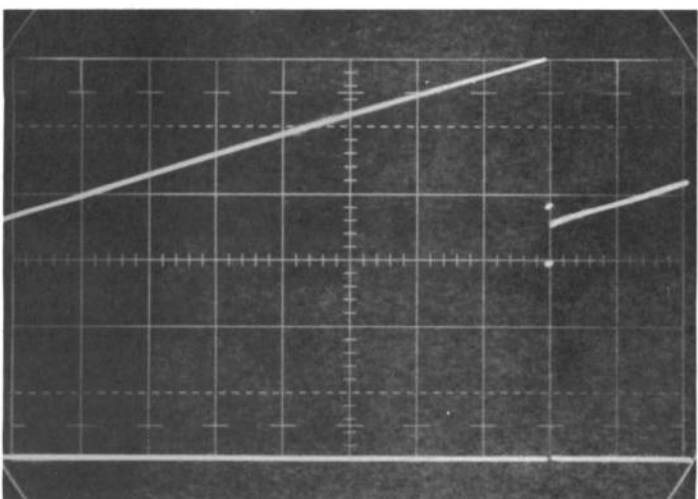
TP2: 2 ms/cm; 50 mV/cm

TP8: 2 ms/cm; 1V/cm



TP2: 2 ms/cm; 50 mV/cm

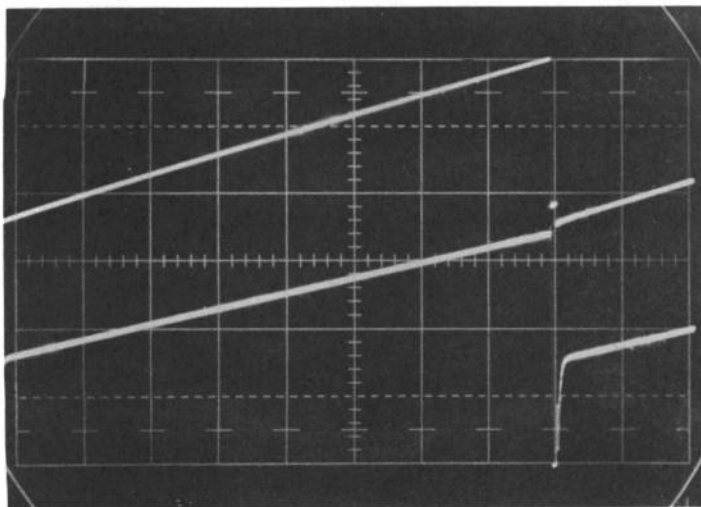
TP13: 2 ms/cm; 1V/cm



TP5: 2 ms/cm; 1V/cm

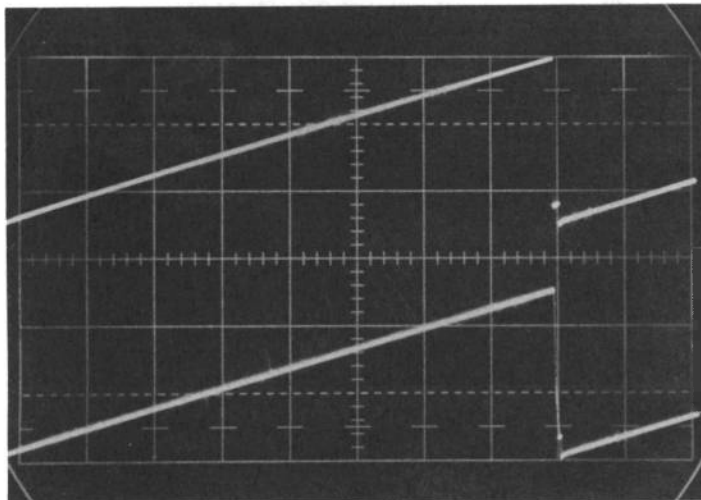
TP13: 2 ms/cm; 1V/cm

Figure 4-15.
Deflection Board 8455901 Waveforms
(945-line scan rate) (Sheet 3 of 4)



TP5: 2 ms/cm; 1V/cm

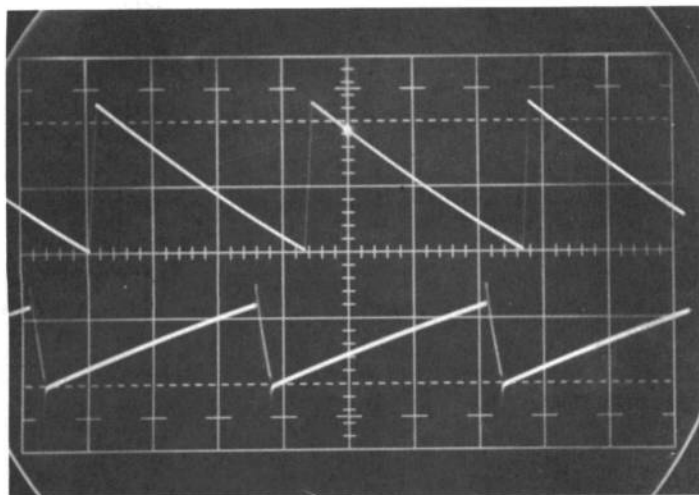
TP6: 2 ms/cm; 5V/cm



TP5: 2 ms/cm; 1V/cm

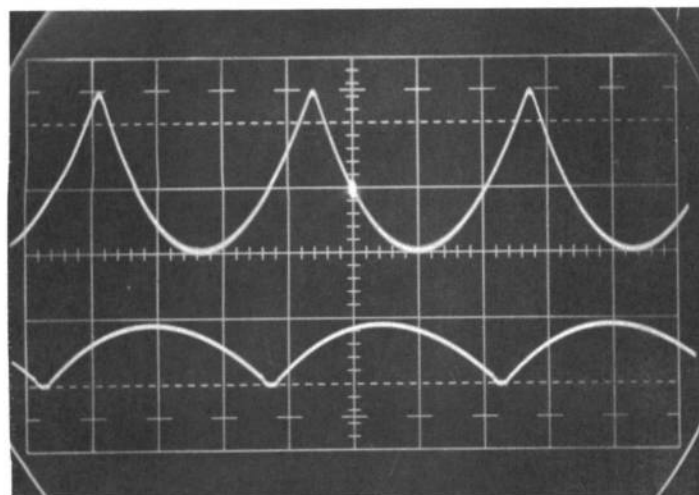
TP4: 2 ms/cm; 1V/cm

Figure 4-15.
Deflection Board 8455901 Waveforms
(945-line scan rate) (Sheet 4 of 4)



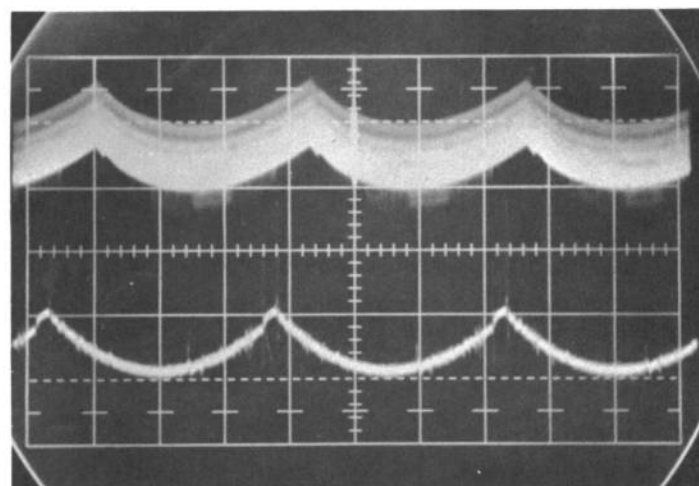
TP1: 5 ms/cm; 500 mV/cm

TP5: 10 μ s/cm; 500 mV/cm



TP2: 5 ms/cm; 200 mV/cm

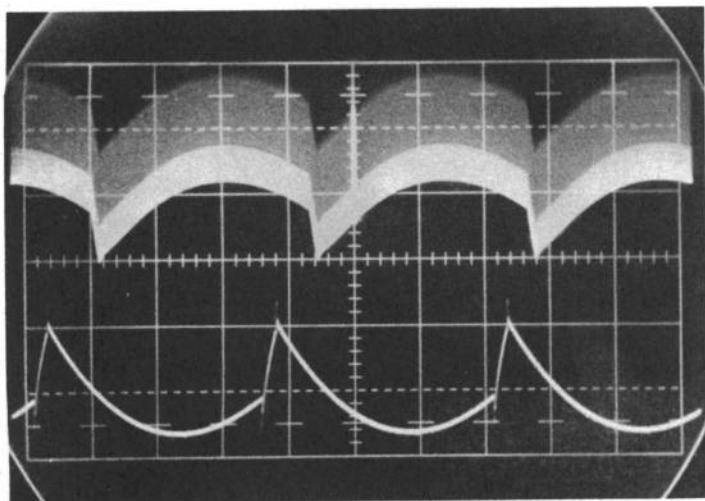
TP6: 10 μ s/cm; 200 mV/cm



TP3: 5 ms/cm; 100 mV/cm

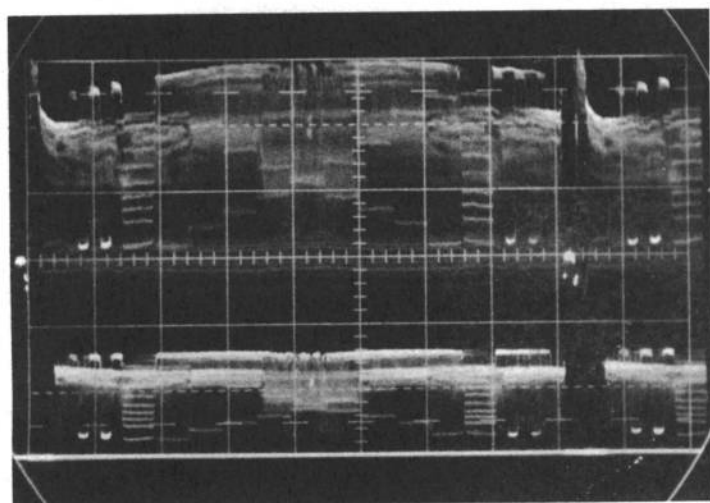
TP3: 10 μ s/cm; 100 mV/cm

Figure 4-16.
Shading Board Waveforms
(945-line scan rate) (Sheet 1 of 2)



TP7: 5 ms/cm; 500 mV/cm
(All sawtooth and parabola
controls set at midpoint)

TP7: 10 μ s/cm; 500 mV/cm
(All sawtooth and parabola
controls set at midpoint)



TP8: 0.6V/cm; 2 ms/cm

TP9: 1V/cm; 2 ms/cm

Figure 4-16.
Shading Board Waveforms
(945-line scan rate) (Sheet 2 of 2)

Table 4-2. Troubleshooting Chart

SYMPTOM	PROBABLE CAUSE	REMEDY
No image appears on TV monitor and PWR lamp on front of camera control is extinguished	Blown fuse	Check F1 (Figure 4-4)
	Burned-out power transformer	Check T1 (Figure 4-3)
No image appears on TV monitor but PWR lamp on front panel of camera control is glowing	Defective voltage regulator	Check +20V, +5V, -10V, +300V, -100V and 6.3V regulators on power-supply board in camera control (Para. 3-34 through 3-39)
	Defective video amplifier stage	Check for continuity of video signal from input terminal (TP-2) to output terminals (TP-3 and TP-4) on video processor board in camera control (Para. 3-3 through 3-17). If video signal is absent at TP2, check continuity of video line in cable from camera; then check video preamplifiers in camera
	Scanning beam cut off at camera	Check setting of BEAM control on power supply board in camera control (Para. 2-8 or 2-9)
	Target voltage too low	Check setting of GAIN control on front panel or auto-target control circuit on video processor board in camera control (Para. 3-16); check setting of target voltage control in camera if camera contains a lead-oxide image tube
	DC voltage on focus grid and/or on anode mesh at image tube in camera incorrect	Check regulated high-voltage supply in camera

Table 4-2. Troubleshooting Chart (cont.)

SYMPTOM	PROBABLE CAUSE	REMEDY
Picture at monitor will not lock horizontally and/or vertically	Amplitude of sync in composite video output signal incorrect	Adjust sync amplitude to 2.86 mV with SYNC LEVEL control on video processor board in camera control
	Lapping over of video peaks into sync area of composite video signal	Check setting of BLANK control on front panel of camera control
Poor contrast between blacks and whites in picture and some snow is present	Inadequate scene lighting	Increase illumination on scene
	Defective video amplifier stage	Check video preamplifier at camera
Picture has no snow but contrast is poor between blacks and whites	Insufficient video gain	Adjust GAIN control on front panel. Repair auto target control on video processor board at camera control (Para. 3-16)
		Adjust gain of video amplifier in camera
		Enlarge opening of iris on lens at camera
Ghosts in picture	Improper termination of video signal cable	Check that video cable is terminated into 75-ohm load at TV monitor
Picture brightness not uniform over entire area of raster and/or resolution of details is poor for white and near-white areas of scene	Insufficient beam current at camera	Increase beam current with BEAM control on power supply board in camera control
Negative picture	Polarity of video output signal reversed	Check polarity selector circuit (Para. 3-5) on video processor board
	Beam current excessive at camera	Reduce beam current with BEAM control on power supply board in camera control

Table 4-2. Troubleshooting Chart (cont.)

SYMPTOM	PROBABLE CAUSE	REMEDY
Negative picture (cont.)	Defective video amplifier stage	Check video amplifiers in both camera and camera control
Resolution of details in black and gray areas of picture poor	Setup incorrect in video signal	Adjust BLANK control on front panel
Picture has white ring around outer edges	Target voltage too high at image tube in camera	Reduce target voltage with front-panel GAIN control or auto target control (Para. 3-16) on video processor board. If turning down GAIN control makes camera sensitivity too low, check video gain at camera and at camera control
Dark horizontal bar rolls vertically through picture and/or the edges of picture are wavy	Ripple in one or more of the power supply voltages	Check voltage regulators on power supply board (Para. 3-35 through 3-39)
Picture has black vertical strip along left edge	Horizontal blanking in video signal too wide	Adjust at blanking signal generator
Picture has vertical strip along right side	Cable delay compensation incorrect	Adjust CABLE DELAY control on deflection board
Picture has black diagonal lines running through it	Beam at camera not being blanked properly during retrace	Check blanking circuit in camera
Highlights in picture have poor detail	Target at camera saturates on white peaks of video signal	Adjust W. PEAK CLIP control on video processor board in camera control (Para. 3-9)

Table 4-2. Troubleshooting Chart (cont.)

SYMPTOM	PROBABLE CAUSE	REMEDY
Entire picture at monitor out of focus	Scene not focused properly on target at camera	Check setting of focus ring on lens
		Check for proper distance between lens and image tube face-plate at camera
	Scanning beam not focused properly on target at camera	Adjust FOCUS control on front panel of camera control
		Adjust G3 and G4 voltages at image tube in camera
Some but not all areas of picture out of focus	Focus modulation on focus grid of image tube incorrect (applicable only if the camera contains the focus-modulator option)	Adjust magnetic FOCUS control in camera
		Check settings of controls on focus modulator board in camera
Poor resolution between different shades of gray in picture	Video amplifier response to changes in light levels not properly compensated	Check setting of GAMMA control on video processor board (Para. 3-12)
Picture does not fill out raster at monitor horizontally	Horizontal deflection signal amplitude too low	Check setting of H. SIZE control on deflection board
Picture does not fill out raster at monitor vertically	Insufficient vertical deflection of scanning beam	Check setting of V. SIZE control on deflection board
Picture compressed at top	Vertical deflection of scanning beam non-linear	Check setting of V. LIN control on deflection board
Picture compressed or expanded at side	Horizontal deflection non-linear	Check setting of horizontal linearity control in camera

4-21. SCHEMATICS

The wiring diagram for the camera control is Figure 4-17. Schematics for the video processor, deflection, power supply and shading boards and for the A1 band-pass filter on the video processor board are in Figure 4-18 through 4-24.

4-22. REPLACEMENT PARTS

Replacement parts for the camera control that may be ordered from the factory or from any authorized sales representative are listed in Tables 4-3 through 4-9. The listings include Cohu part numbers, component descriptions and circuit designers. The latter correspond to those used in the schematics.

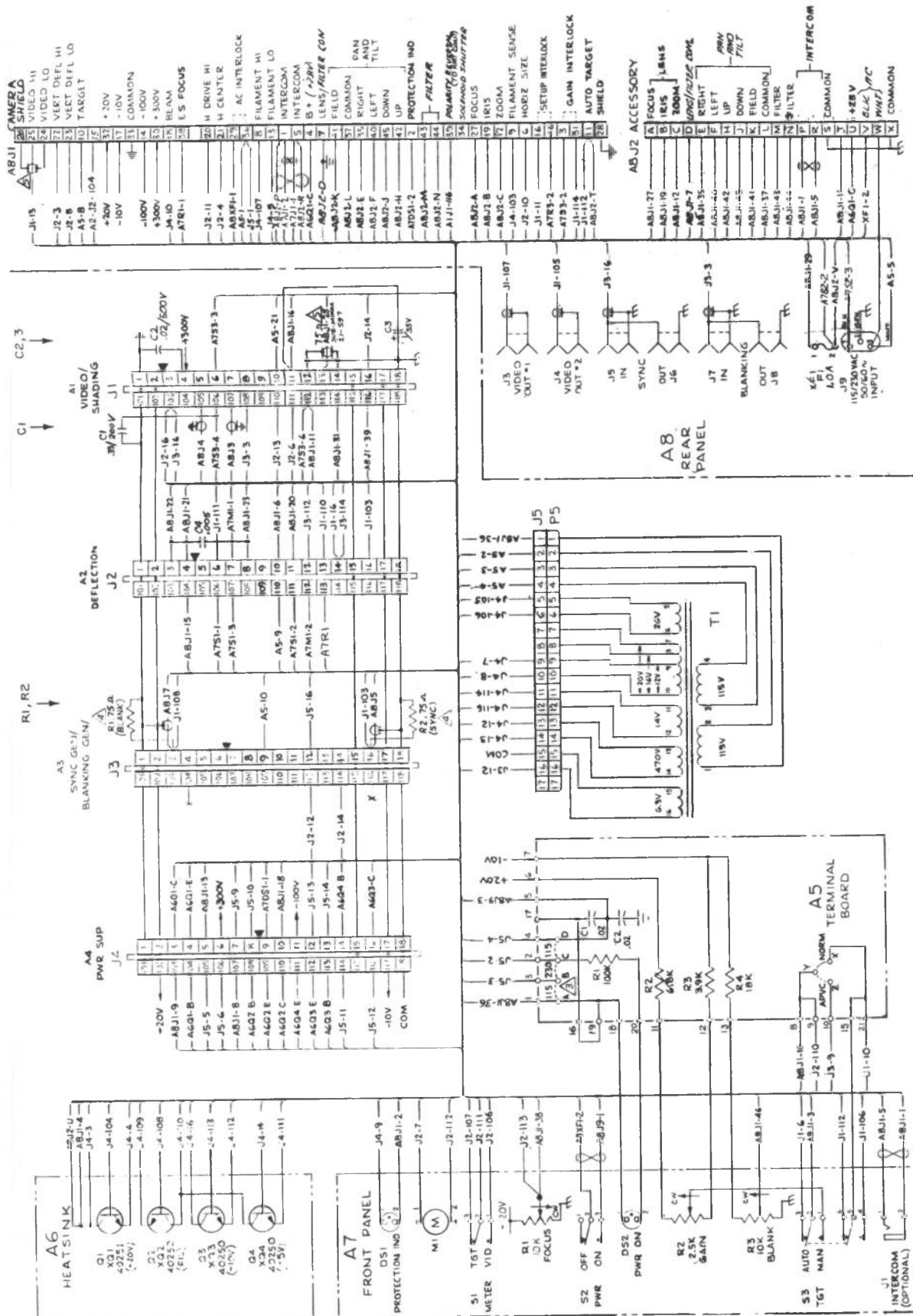


Figure 4-17. Camera Control Wiring Diagram (Dwg. D8459400E)

NOTES: UNLESS OTHERWISE SPECIFIED

- 1. DUAL FORWARD SHIELD LEADS PER MM-1
- 2. REMOVE R1 AND/OR R2 IF BLANKING AND/OR SYNC OUTPUTS ARE TERMINATED ELSEWHERE IN SYSTEM.
- 3. FOR 115V OPERATION JUMPER A TO B & C TO D; FOR 230V JUMPER B TO C.
- 4. CAPACITOR VALUES ARE IN UF
- 5. RESISTOR VALUES ARE IN OHMS

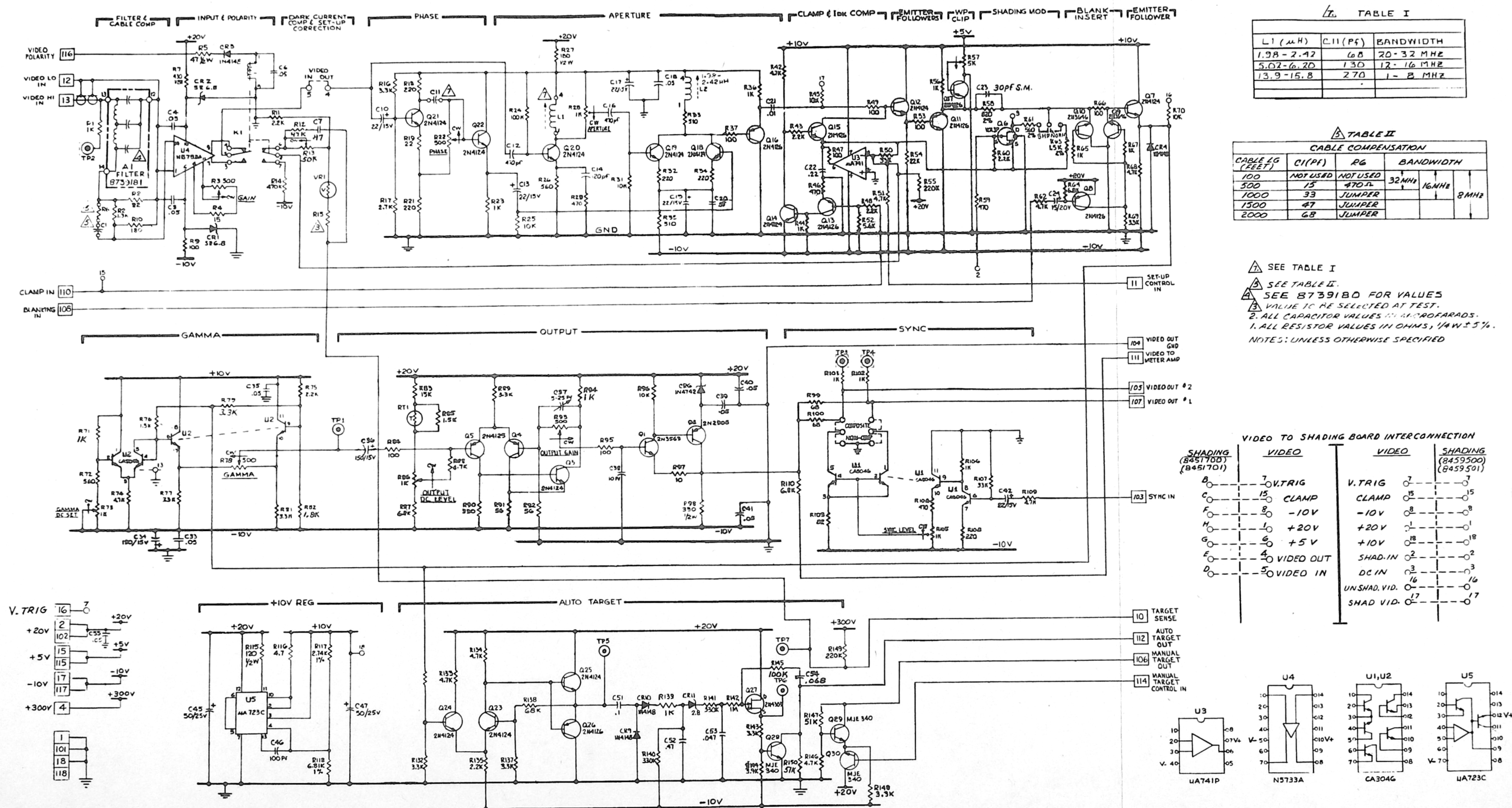
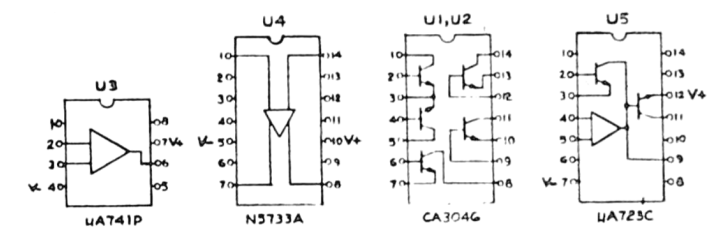
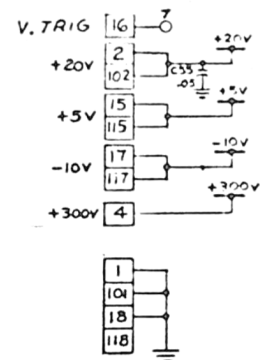
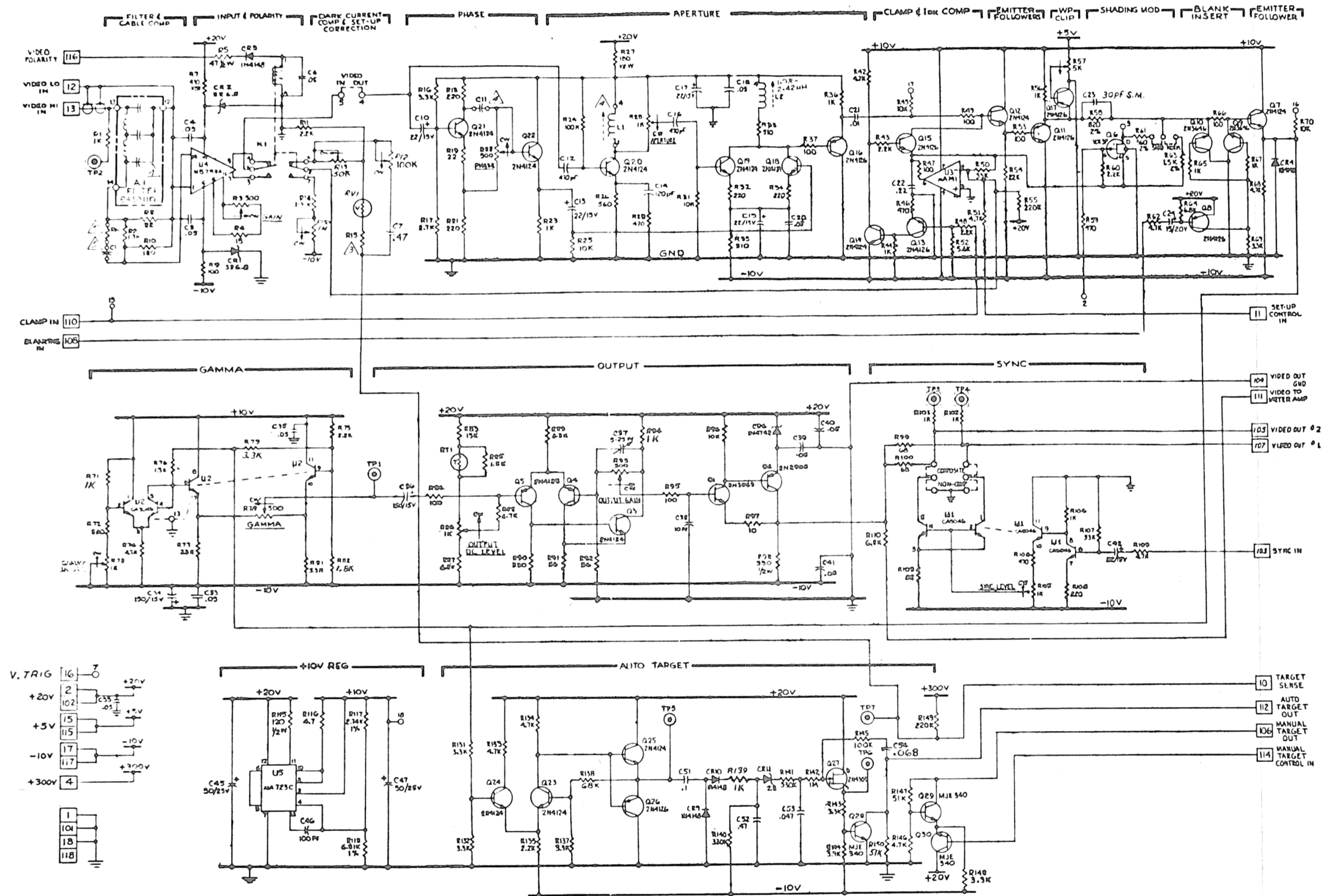


Figure 4-18. Video Board Schematic (Dwg. D8459100)
(S/ N 1-, 2- or 3-0001 through 1-, 2- or 3-0025)



1. SEE TABLE II.
2. SEE TABLE I.
3. VALUE TO BE SELECTED AT TEST.
4. ALL CAPACITOR VALUES IN MICROFARADS.
5. ALL RESISTOR VALUES IN OHMS, 1/4W ± 5%.
NOTES: UNLESS OTHERWISE SPECIFIED

TABLE I

AI FILTER BOARD	L1 (UH)	C11 (PF)	BANDWIDTH
R459111-032	1.98-2.42	68	32 MHz
R459111-016	5.02-6.20	130	16 MHz
R459111-008	13.9-15.8	270	8 MHz

TABLE II

CABLE COMPENSATION			
CABLE LG (FEET)	C1 (PF)	R6	BANDWIDTH
100	NOT USED	NOT USED	32 MHz
500	15	470 Ω	16 MHz
1000	33	JUMPER	8 MHz
1500	47	JUMPER	
2000	68	JUMPER	

Figure 4-19a. Video Board Schematic (Dwg. D8459100B)
(S/N 1-, 2- or 3-0026 through 1-, 2- or 3-0075)

NOT AVAILABLE FOR REPRODUCTION

Figure 4-19b. Video Board Schematic, Dwg. D8459100

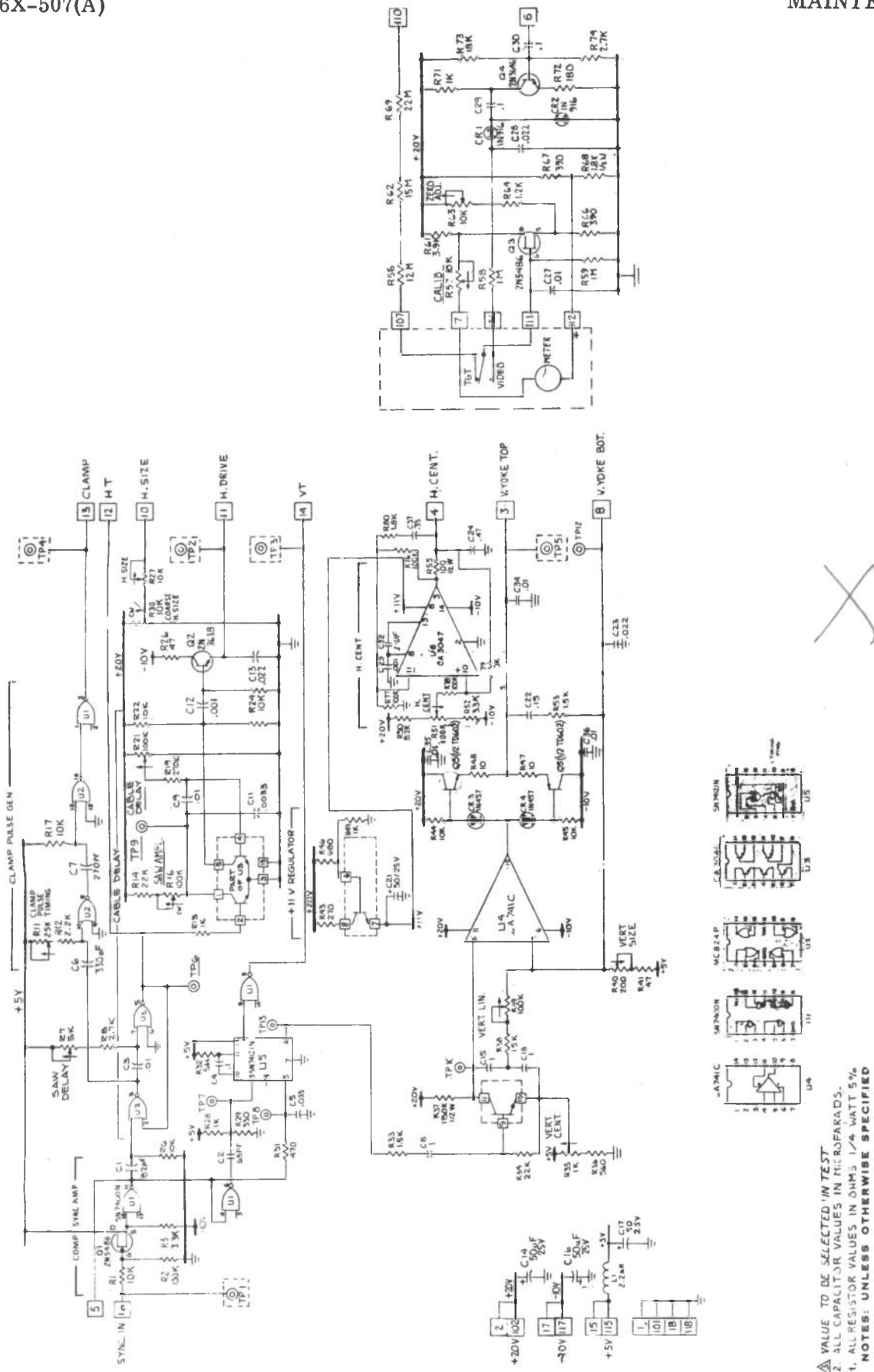
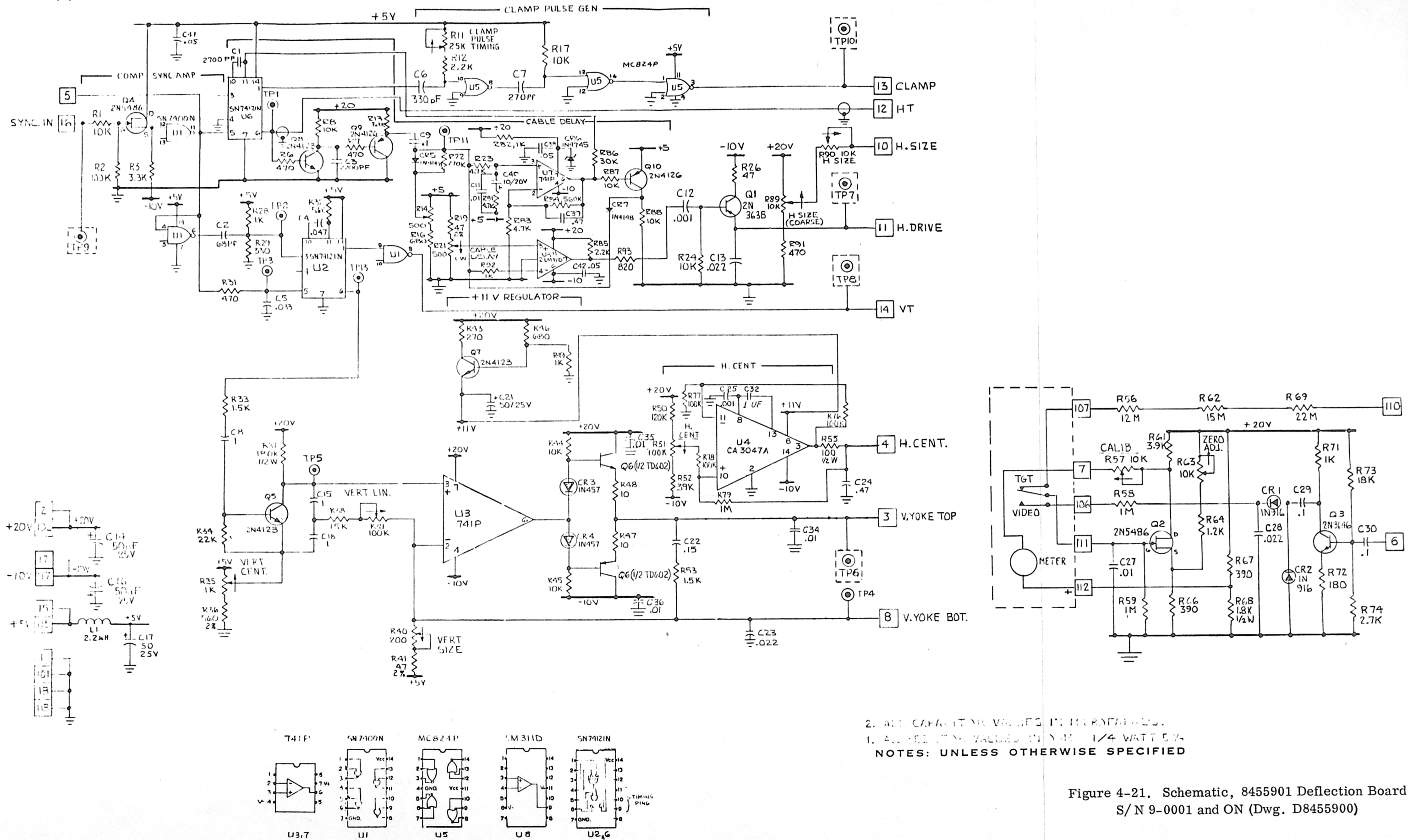
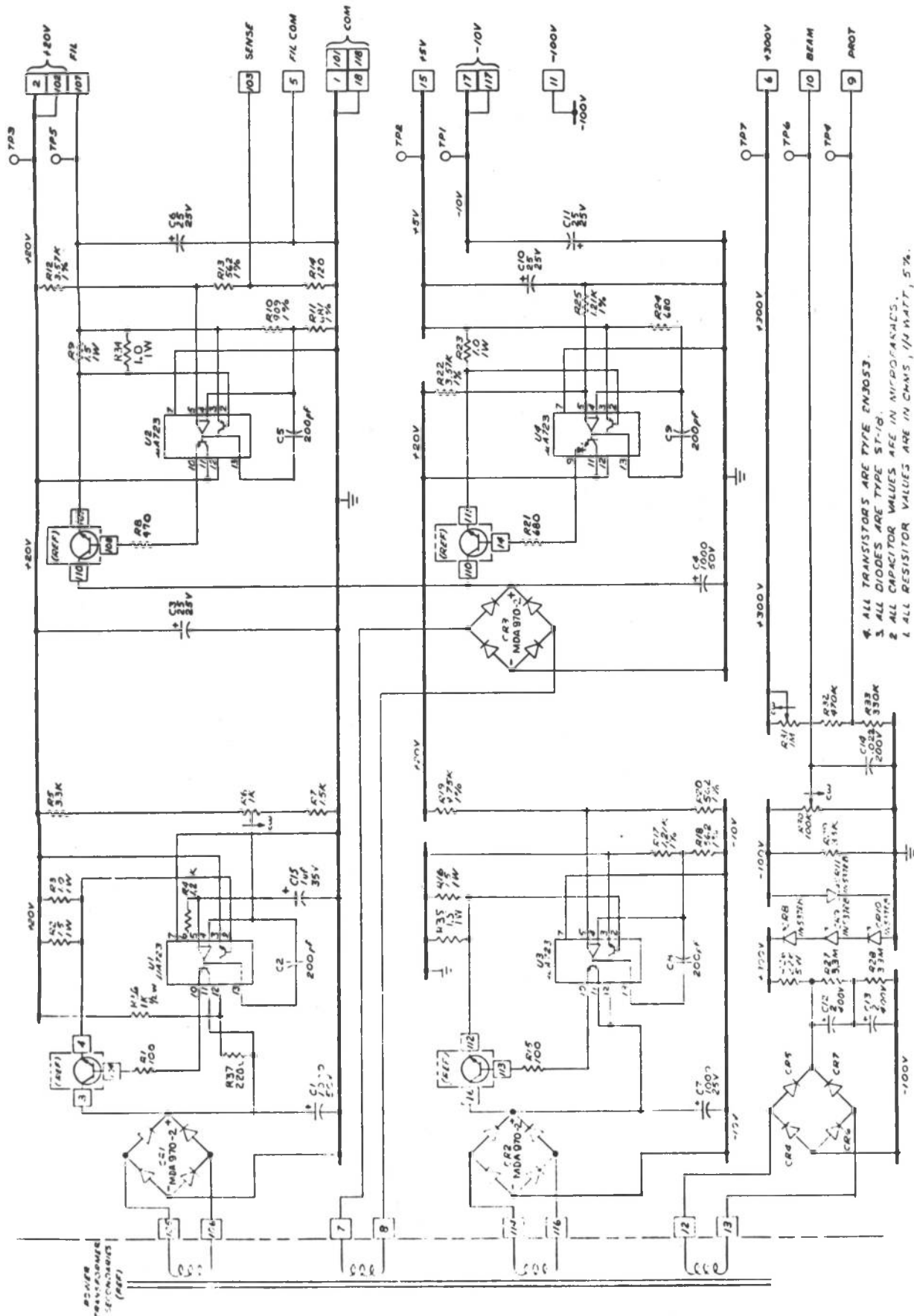


Figure 4-20. Schematic, 8455801 Deflection Board, S/N 8-0001 and ON (Dwg. D8455800A)





4. ALL TRANSISTORS ARE TYPE 2N3053.
 3. ALL DIODES ARE TYPE 5T-10.
 2. ALL CAPACITOR VALUES ARE IN MICROFARADS.
 1. ALL RESISTOR VALUES ARE IN OHMS, 1/4 WATT, 5%.

NOTES: UNLESS OTHERWISE SPECIFIED

Figure 4-22. Schematic, Power Supply Board (Dwg. D8454210D)

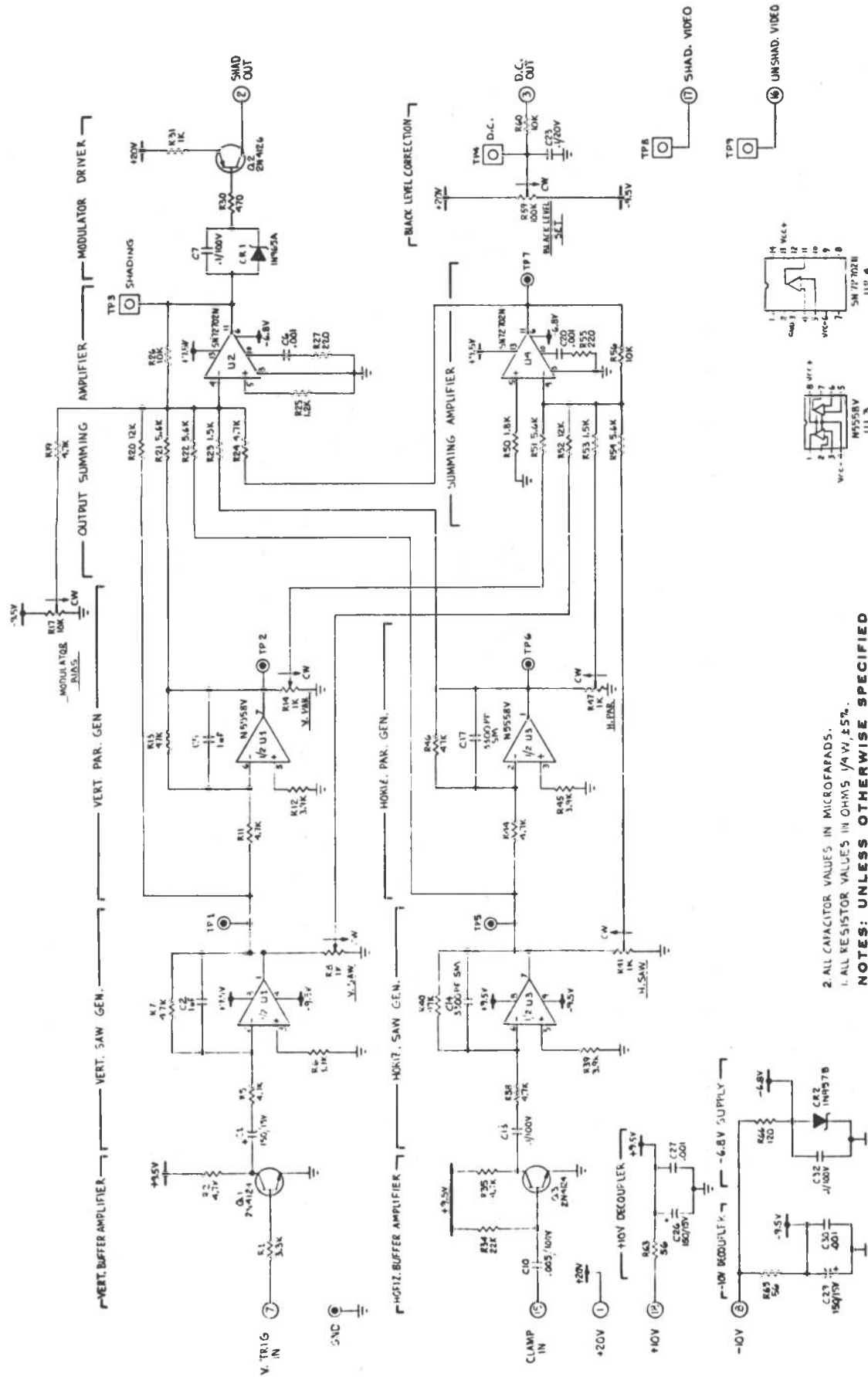


Figure 4-23a. Schematic, Optional Shading Board (Dwg. 8459500) (S/N 5-0001 through 5-0005)

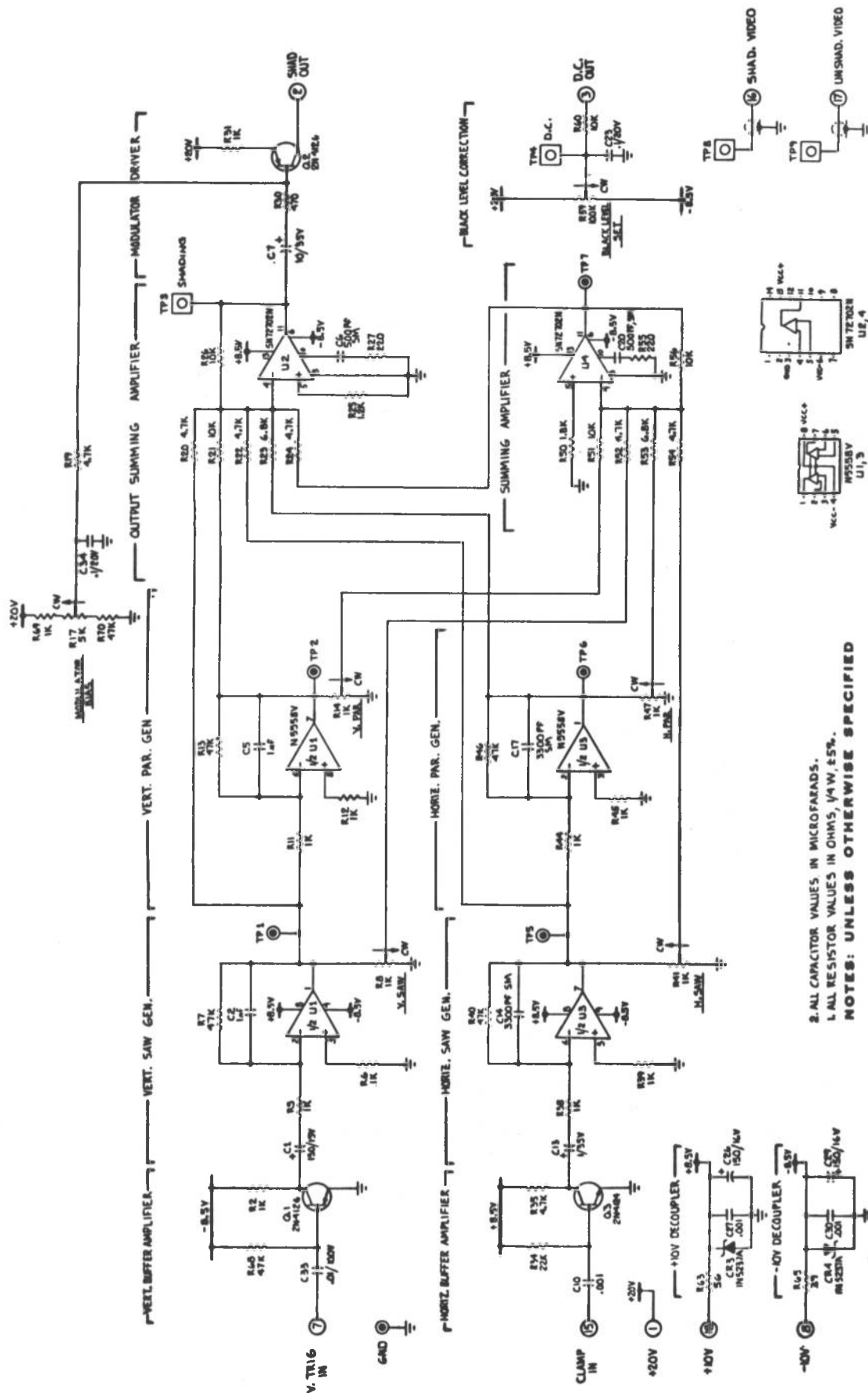


Figure 4-23b. Schematic, Optional Shading Board (Dwg. D8459500A) (S/N 5-0006 and ON)

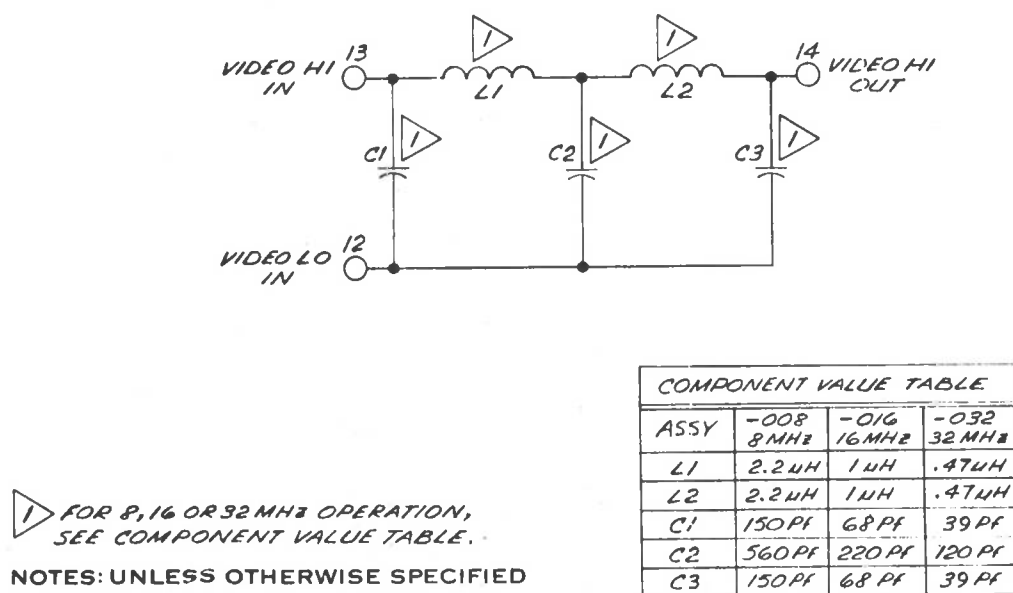
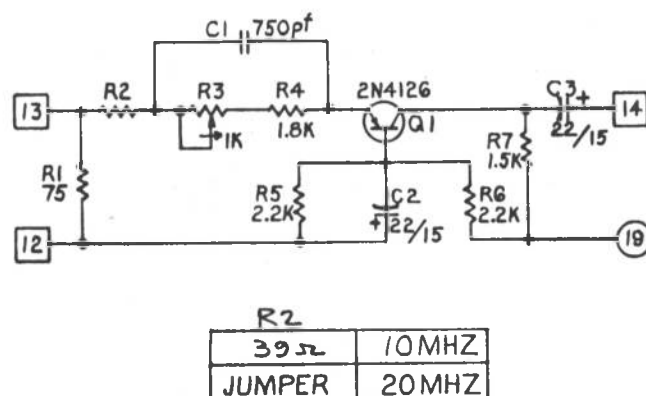


Figure 4-24a. Schematic, A1 Bandpass Filter (Dwg. B8459110)



6. RESISTOR VALUES IN OHMS $\frac{1}{4}$ W. CAPACITOR VALUES IN μ f.
5. RUBBER STAMP APPROPRIATE MHZ NO. AS SHOWN.
4. SILKSCREEN IN WHT USING 3310034-002.
3. FAB & ASSY PER MM-12.
2. MATERIAL: .062 THK EPOXY GLASS PER 2510058-212.
1. USE ART 8459701-002 VER (1) & -003 VER (2)

NOTES: UNLESS OTHERWISE SPECIFIED

Figure 4-24b. Schematic, Hi Peaker (Dwg. C8459701) (2000 Series Cameras)

Table 4-3. Replacement Parts, Camera Control Main Assembly

CIRCUIT REF.		DESCRIPTION	COHU PART NO.
A	1	VIDEO PROCESSOR BOARD ASSY	8459101--001
A	1	BANDPASSY FILTER ASSY	8459111-032
A	1	SHADING BOARD ASSY	8459501--001
A	2	DEFLECTION BOARD ASSY	8455801--001
A	2	DEFLECTION BOARD ASSY	8455901--001
A	3	SYNC GENERATOR BOARD 525 LINE ONLY	8455501--001
A	3	SYNC GENERATOR BOARD VAR SCAN RATE	8455601--001
A	3	BLANKING GENERATOR OPTION	8456101--001
A	4	POWER SUPPLY BOARD ASSY	8454211--001
*C	1	CAPACITOR, LINE BY-PASS, .02UF, 1.4KV	0410013--001
C	1	CAPACITOR, MYLAR, 0.33UF, 200V	0610133--025
C	2	CAPACITOR, CERAMIC DISC, .02UF, 500V	0401058
*C	2	CAPACITOR, LINE BY-PASS, .02UF, 1.4KV	0410013--001
**C	3	CAPACITOR, 1.0 MFD, 35V	0510151--007
***C	4	CAPACITOR, .005 MFD, 500V	0401054
DS	1	INDICATOR LAMP ASSEMBLY, RED CLEAR.	1710152--004
DS	2	INDICATOR LAMP ASSEMBLY	1710152--003
M	1	METER 0-1 MA ROUND FACE.	3010019--001
Q	1	TRANSISTOR, TYPE 40251	7210033--018
Q	2	TRANSISTOR, TYPE 40250	7210071--001
Q	3	TRANSISTOR, TYPE 40250	7210071--001
Q	4	TRANSISTOR, TYPE 40250	7210071--001
R	1	RESISTOR, CARBON, 1/4W, 5%, 100 KILOHM	4045000--104
R	1	RESISTOR, CARBON, 1/4W, 5%, 75 OHM	4045000--750
R	1	RESISTOR, VARIABLE, 1/2W, 20%, 2.5 KILOHMS	5010128--103
R	2	RESISTOR, CARBON, 1/4W, 5%, 6.8 KILOHM	4045000--682
R	2	RESISTOR, CARBON, 1/4W, 5%, 75 OHM	4045000--750
R	2	RESISTOR, VARIABLE, 1/2W, 20%, 10 KILOHMS	5010128--252
R	3	RESISTOR, CARBON, 1/4W, 5%, 3.9 KILOHM	4045000--392
R	3	RESISTOR, VARIABLE, 1/2W, 20%, 2.5 KILOHMS	5010128--103
R	4	RESISTOR, CARBON, 1/4W, 5%, 18 KILOHM	4045000--183
S	1	SWITCH, TOGGLE, DPDT	6110089--001
S	2	SWITCH, TOGGLE, DPDT	6110089--001
S	3	SWITCH, TOGGLE, DPDT	6110089--001
T	1	TRANSFORMER	8454124--001
		*ON A7 FRONT PANEL ASSY	
		**USED IN SERIAL NUMBER 4-0031 AND ON	
		***USED IN SERIAL NUMBER 4-0076 AND ON	

Table 4-4a. Video Board Replacement Parts (S/N 1-, 2- or 3-0075 or Lower)

CIRCUIT REF.		DESCRIPTION	COHU PART NO.
C	1	CAPACITOR, SILVER MICA, 500V, SELECT IN TEST	1010006-
C	3	CAPACITOR, CERAMIC, .05UF, 50V SELECT IN TEST	0410009-503
C	4	CAPACITOR, CERAMIC .05UF 50V	0410009-503
C	6	CAPACITOR, CERAMIC .05UF 50V	0410009-503
* C	7	CAPACITOR, MYLAR, 0.47MFD, 100V	0610136-474
C	10	CAPACITOR, TANTALUM, 22UF, 15V	0510151-037
C	11	CAP, SILV MICA, 500V (SEE TABLE IN SCHEMATIC)	1010006-
C	12	CAPACITOR, CERAMIC DISC, 470PF, 1KV	0401038
C	13	CAPACITOR, TANTALUM, 22UF, 15V	0510151-037
C	14	CAPACITOR, SILVER, MICA 120PF 100V	1010005-121
C	16	CAPACITOR, CERAMIC DISC, 470PF, 1KV	0401038
C	17	CAPACITOR, TANTALUM, 22UF, 15V	0510151-037
C	18	CAPACITOR, CERAMIC .05UF 50V	0410009-503
C	19	CAPACITOR, TANTALUM, 22UF, 15V	0510151-037
C	20	CAPACITOR, CERAMIC .05UF 50V	0410009-503
C	21	CAPACITOR, FILM, 0.01FD, 100V	0610136-103
C	22	CAPACITOR, FILM, 0.22MFD, 100V	0610136-224
C	23	CAPACITOR CERAMIC DISC. 30PF 1KV	0401012
C	24	CAPACITOR, TANTALUM, 15 UF, 20V	0510151-032
C	33	CAPACITOR, CERAMIC .05UF 50V	0410009-503
C	34	CAPACITOR, TANTALUM, 150UF, 15V	0510155-001
C	35	CAPACITOR, CERAMIC .05UF 50V	0410009-503
C	36	CAPACITOR, TANTALUM, 150UF, 15V	0510155-001
C	37	CAPACITOR, VARIABLE, 5-25PF	0910002-001
C	38	CAPACITOR, CERAMIC DISC, 10PF, 1KV	0401004
C	39	CAPACITOR, CERAMIC .05UF 50V	0410009-503
C	40	CAPACITOR, CERAMIC .05UF 50V	0410009-503
C	41	CAPACITOR, CERAMIC .05UF 50V	0410009-503
C	42	CAPACITOR, TANTALUM, 22UF, 15V	0510151-037
C	45	CAPACITOR ELECTROLYTIC 50UF 25V	0510147-043
C	46	CAPACITOR, SILVER MICA, 100 PF, 1. KV	1010005-101
C	47	CAPACITOR ELECTROLYTIC 50UF 25V	0510147-043
C	51	CAPACITOR, FILM, .10UF, 100V	0610136-104
C	52	CAPACITOR, MYLAR, 0.47MFD, 100V	0610136-474
C	53	CAPACITOR, FILM, 0.047MFD, 100V	0610136-473
* C	54	CAPACITOR, MYLAR, 0.068MFD, 100V	0610136-683
C	55	CAPACITOR, CERAMIC .05UF 50V	0410009-503
CR	1	DIODE, ZENER, TYPE SZ6.8	3510049-021
CR	2	DIODE, ZENER, TYPE SZ6.8	3510049-021
CR	3	DIODE SWITCH TYPE 1N4148	3510042-029
CR	4	DIODE SWITCH TYPE 1N4148	3510042-029
CR	6	ZENER DIODE, 1N4742	3510036-052
CR	9	DIODE SWITCH TYPE 1N4148	3510042-029
CR	10	DIODE SWITCH TYPE 1N4148	3510042-029
CR	11	DIODE, ZENER, TYPE HR2.8	3510036-015
K	1	RELAY, DPDT, SV, 50 OHM	3710076-001
L	1	INDUCTOR (SEE SCHEMATIC)	2310056-
L	2	INDUCTOR, VARIABLE, 1.98-2.42 UH	2310056-010
Q	1	TRANSISTOR, 2N3563	7210068-005
Q	2	TRANSISTOR, TYPE 2N2905	7210090-002
Q	3	TRANSISTOR, TYPE 2N4124	7210072-002

Table 4-4a. Video Board Replacement Parts (S/N 1-, 2- or 3-0075 or Lower) (Cont.)

CIRCUIT REF.		DESCRIPTION	COHU PART NO.
Q	4	TRANSISTOR, TYPE 2N4125	7210064-009
Q	5	TRANSISTOR, TYPE 2N4125	7210064-009
Q	6	TRANSISTOR, VCR-3P	7210105-001
Q	7	TRANSISTOR, TYPE 2N4124	7210072-002
Q	8	TRANSISTOR, TYPE 2N4126	7210072-003
Q	9	TRANSISTOR, TYPE 2N3646	7210068-001
Q	10	TRANSISTOR, TYPE 2N3646	7210068-001
Q	11	TRANSISTOR, TYPE 2N4126	7210072-003
Q	12	TRANSISTOR, TYPE 2N4124	7210072-002
Q	13	TRANSISTOR, TYPE 2N4126	7210072-003
Q	14	TRANSISTOR, TYPE 2N4124	7210072-002
Q	15	TRANSISTOR, TYPE 2N4126	7210072-003
Q	16	TRANSISTOR, TYPE 2N4126	7210072-003
Q	17	TRANSISTOR, TYPE 2N4126	7210072-003
Q	18	TRANSISTOR, TYPE 2N4124	7210072-002
Q	19	TRANSISTOR, TYPE 2N4124	7210072-002
Q	20	TRANSISTOR, TYPE 2N4124	7210072-002
Q	21	TRANSISTOR, TYPE 2N4124	7210072-002
Q	22	TRANSISTOR, TYPE 2N4124	7210072-002
Q	23	TRANSISTOR, TYPE 2N4124	7210072-002
Q	24	TRANSISTOR, TYPE 2N4124	7210072-002
Q	25	TRANSISTOR, TYPE 2N4124	7210072-002
Q	26	TRANSISTOR, TYPE 2N4126	7210072-003
Q	27	TRANSISTOR, FIELD EFFECT, TYPE 2N4303	7210082-002
Q	28	TRANSISTOR, MJE-340	7210085-003
Q	29	TRANSISTOR, MJE-340	7210085-003
Q	30	TRANSISTOR, MJE-340	7210085-003
R	1	RESISTOR, CARBON, 1/4W, 5%, 1 KILOHM	4010025-102
R	2	RESISTOR, CARBON, 1/4W, 5%, 1.3 KILOHMS	4010025-132
R	3	RESISTOR, VARIABLE, .5W, 500 OHM	5010097-001
R	4	RESISTOR, CARBON, 1/4W, 5%, 15 OHMS	4010025-150
R	5	RESISTOR, 1/2 WATT, 5%, 47 OHM	0310030-470
R	6	RESISTOR, 1/4W, 5% (SEE TABLE IN SCHEMATIC)	4010025-
R	7	RESISTOR, COMPOSITION, 1/2W, 5%, 430 OHMS	0310030-431
R	8	RESISTOR, CARBON, 1/4W, 5%, 82 OHM	4010025-820
R	9	RESISTOR, CARBON, 1/4W, 5%, 100 OHM	4010025-101
R	10	RESISTOR, CARBON, 1/4W, 5%, 180 OHMS	4010025-181
R	11	RESISTOR, CARBON, 1/4W, 5%, 2.2 KILOHM	4010025-222
R	12	RESISTOR, VARIABLE, .5W, 100 KILOHM	5010097-011
R	13	RESISTOR, VARIABLE, .5W, 50 KILOHM	5010097-012
*R	14	RESISTOR, CARBON, 1/4W, 5%, 100 KILOHM	4010025-104
R	15	JUMPER, INSULATED, 1000V, 22 AWG	7610032-999
R	16	RESISTOR, CARBON, 1/4W, 5%, 3.3 KILOHM	4010025-332
R	17	RESISTOR, CARBON, 1/4W, 5%, 2.7 KILOHMS	4010025-272
R	18	RESISTOR, CARBON, 1/4W, 5%, 220 OHM	4010025-221
R	19	RESISTOR, CARBON, 1/4W, 5%, 22 OHM	4010025-220
R	21	RESISTOR, CARBON, 1/4W, 5%, 220 OHM	4010025-221
R	22	RESISTOR, VARIABLE, 1/2W 500 OHM, 20%	5010120-501
R	23	RESISTOR, CARBON, 1/4W, 5%, 1 KILOHM	4010025-102
R	24	RESISTOR, CARBON, 1/4W, 5%, 100 KILOHM	4010025-104
R	25	RESISTOR, CARBON, 1/4W, 5%, 10 KILOHM	4010025-103

Table 4-4a. Video Board Replacement Parts (S/N 1-, 2- or 3-0075 or Lower) (Cont.)

CIRCUIT REF.	DESCRIPTION	COHU PART NO.
R 26	RESISTOR, CARBON, 1/4W, 5%, 560 OHMS	4010025-561
R 27	RESISTOR, 1/2 WATT, 5%, 180 OHM	0310030-181
R 28	RESISTOR, VARIABLE, 1/2W, 1K, 20%	5010120-102
R 29	RESISTOR, CARBON, 1/4W, 5%, 470 OHM	4010025-471
R 31	RESISTOR, CARBON, 1/4W, 5%, 10 KILOHM	4010025-103
R 32	RESISTOR, CARBON, 1/4W, 5%, 220 OHM	4010025-221
R 33	RESISTOR, CARBON, 1/4W, 5%, 510 OHMS	4010025-511
R 34	RESISTOR, CARBON, 1/4W, 5%, 220 OHM	4010025-221
R 35	RESISTOR, CARBON, 1/4W, 5%, 510 OHMS	4010025-511
R 36	RESISTOR, CARBON, 1/4W, 5%, 1 KILOHM	4010025-102
R 36	RESISTOR, CARBON, 1/4W, 5%, 1.5 KILOHM	4010025-152
R 37	RESISTOR, CARBON, 1/4W, 5%, 100 OHM	4010025-101
R 42	RESISTOR, CARBON, 1/4W, 5%, 4.7 KILOHM	4010025-472
R 43	RESISTOR, CARBON, 1/4W, 5%, 2.2 KILOHM	4010025-222
R 44	RESISTOR, CARBON, 1/4W, 5%, 1 KILOHM	4010025-102
R 45	RESISTOR, CARBON, 1/4W, 5%, 10 KILOHM	4010025-103
R 46	RESISTOR, CARBON, 1/4W, 5%, 470 OHM	4010025-471
R 47	RESISTOR, CARBON, 1/4W, 5%, 100 OHM	4010025-101
R 48	RESISTOR, CARBON, 1/4W, 5%, 220 OHM	4010025-222
R 49	RESISTOR, CARBON, 1/4W, 5%, 100 OHM	4010025-101
R 50	RESISTOR, CARBON, 1/4W, 5%, 33 KILOHM	4010025-333
R 51	RESISTOR, CARBON, 1/4W, 5%, 4.7 KILOHM	4010025-472
R 52	RESISTOR, CARBON, 1/4W, 5%, 5.6 KILOHM	4010025-562
R 53	RESISTOR, CARBON, 1/4W, 5%, 100 OHM	4010025-101
R 54	RESISTOR, CARBON, 1/4W, 5%, 2.2 KILOHM	4010025-223
R 55	RESISTOR, CARBON, 1/4W, 5%, 220 KILOHMS	4010025-224
R 56	RESISTOR, CARBON, 1/4W, 5%, 1 KILOHM	4010025-102
R 57	RESISTOR, VARIABLE, 1/2W, 5K OHM 20%	5010120-502
R 58	RESISTOR, METAL OXIDE, 1/4W, 2%, 820 OHMS	0310111-821
R 59	RESISTOR, CARBON, 1/4W, 5%, 470 OHM	4010025-471
R 60	RESISTOR, CARBON, 1/4W, 5%, 2.2 KILOHM	4010025-222
R 61	RESISTOR, METAL OXIDE, 1/4W, 2%, 560 OHMS	0310111-561
R 62	RESISTOR, CARBON, 1/4W, 5%, 4.7 KILOHM	4010025-472
R 63	RESISTOR, METAL OXIDE, 1/4W, 2%, 1.5 KILOHMS	0310111-152
R 64	RESISTOR, CARBON, 1/4W, 5%, 6.8 KILOHM	4010025-682
R 65	RESISTOR, CARBON, 1/4W, 5%, 1 KILOHM	4010025-102
R 66	RESISTOR, CARBON, 1/4W, 5%, 100 OHM	4010025-101
R 67	RESISTOR, CARBON, 1/4W, 5%, 1 KILOHM	4010025-102
R 68	RESISTOR, CARBON, 1/4W, 5%, 4.7 KILOHM	4010025-472
R 69	RESISTOR, CARBON, 1/4W, 5%, 3.3 KILOHM	4010025-332
R 70	RESISTOR, CARBON, 1/4W, 5%, 10 KILOHM	4010025-103
R 71	RESISTOR, CARBON, 1/4W, 5%, 1 KILOHM	4010025-102
R 72	RESISTOR, CARBON, 1/4W, 5%, 560 OHMS	4010025-561
R 73	RESISTOR, VARIABLE, .5W, 1 KILOHM	5010097-003
R 74	RESISTOR, CARBON, 1/4W, 5%, 4.7 KILOHM	4010025-472
R 75	RESISTOR, CARBON, 1/4W, 5%, 2.2 KILOHM	4010025-222
R 77	RESISTOR, CARBON, 1/4W, 5%, 3.3 KILOHM	4010025-332
R 78	RESISTOR, VARIABLE, 1/2W 500 OHM, 20%	5010120-501
R 79	RESISTOR, CARBON, 1/4W, 5%, 3.3 KILOHM	4010025-332
R 81	RESISTOR, CARBON, 1/4W, 5%, 3.3 KILOHM	4010025-332

Table 4-4a. Video Board Replacement Parts (S/N 1-, 2- or 3-0075 or Lower) (Cont.)

CIRCUIT REF.	DESCRIPTION	COHU PART NO.
R 82	RESISTOR, CARBON, 1/4W, 5%, 1.8 KILOHM	4010025-182
R 83	RESISTOR, CARBON, 1/4W, 5%, 15 KILOHM	4010025-153
R 84	RESISTOR, CARBON, 1/4W, 5%, 100 OHM	4010025-101
R 85	RESISTOR, CARBON, 1/4W, 5%, 1.5 KILOHM	4010025-152
R 86	RESISTOR, VARIABLE, .5W, 1 KILOHM	5010097-003
R 87	RESISTOR, CARBON, 1/4W, 5%, 6.8 KILOHM	4010025-682
R 88	RESISTOR, CARBON, 1/4W, 5%, 4.7 KILOHM	4010025-472
R 89	RESISTOR, CARBON, 1/4W, 5%, 3.3 KILOHM	4010025-332
R 90	RESISTOR, CARBON, 1/4W, 5%, 330 OHM	4010025-331
R 91	RESISTOR, CARBON, 1/4W, 5%, 56 OHMS	4010025-560
R 92	RESISTOR, CARBON, 1/4W, 5%, 56 OHMS	4010025-560
R 93	RESISTOR, VARIABLE, .5W, 500 OHM	5010097-001
R 94	RESISTOR, CARBON, 1/4W, 5%, 1 KILOHM	4010025-102
R 95	RESISTOR, CARBON, 1/4W, 5%, 100 OHM	4010025-101
R 96	RESISTOR, CARBON, 1/4W, 5%, 10 KILOHM	4010025-103
R 97	RESISTOR, CARBON, 1/4W, 5%, 10 OHM	4010025-100
R 98	RESISTOR, 1/2 WATT, 5%, 330 OHM	0310030-331
R 99	RESISTOR, CARBON, 1/4W, 5%, 68 OHMS	4010025-680
R 100	RESISTOR, CARBON, 1/4W, 5%, 68 OHMS	4010025-680
R 101	RESISTOR, CARBON, 1/4W, 5%, 1 KILOHM	4010025-102
R 102	RESISTOR, CARBON, 1/4W, 5%, 1 KILOHM	4010025-102
R 103	RESISTOR, CARBON, 1/4W, 5%, 82 OHM	4010025-820
R 104	RESISTOR, CARBON, 1/4W, 5%, 470 OHM	4010025-471
R 105	RESISTOR, VARIABLE, 1/2W, 1K, 20%	5010120-102
R 106	RESISTOR, CARBON, 1/4W, 5%, 1 KILOHM	4010025-102
R 107	RESISTOR, CARBON, 1/4W, 5%, 33 KILOHM	4010025-333
R 108	RESISTOR, CARBON, 1/4W, 5%, 22 OHM	4010025-221
R 109	RESISTOR, CARBON, 1/4W, 5%, 4.7 KILOHM	4010025-472
R 110	RESISTOR, CARBON, 1/4W, 5%, 6.8 KILOHM	4010025-682
R 115	RESISTOR, 1/2 WATT, 5%, 120 OHM	0310030-121
R 116	RESISTOR, CARBON, 1/4W, 5%, 4.7 OHMS	4045000-047
R 117	RESISTOR, PRECISION, 1%, 2.74 KILOHM	4710036-011
R 118	RESISTOR, PRECISION, 1%, 6.81 KILOHM	4710036-035
R 131	RESISTOR, CARBON, 1/4W, 5%, 3.3 KILOHM	4010025-332
R 132	RESISTOR, CARBON, 1/4W, 5%, 3.3 KILOHM	4010025-332
R 133	RESISTOR, CARBON, 1/4W, 5%, 4.7 KILOHM	4010025-472
R 134	RESISTOR, CARBON, 1/4W, 5%, 4.7 KILOHM	4010025-472
R 135	RESISTOR, CARBON, 1/4W, 5%, 2.2 KILOHM	4010025-222
R 137	RESISTOR, CARBON, 1/4W, 5%, 3.3 KILOHM	4010025-332
R 138	RESISTOR, CARBON, 1/4W, 5%, 68 KILOHMS	4010025-683
R 139	RESISTOR, CARBON, 1/4W, 5%, 1 KILOHM	4010025-102
R 140	RESISTOR, CARBON, 1/4W, 5%, 330 KILOHM	4010025-334
R 141	RESISTOR, CARBON, 1/4W, 5%, 330 KILOHM	4010025-334
R 142	RESISTOR, CARBON, 1/4W, 5%, 1.0 MEGOHM	4045000-105
R 143	RESISTOR, CARBON, 1/4W, 5%, 3.3 KILOHM	4010025-332
R 144	RESISTOR, CARBON, 1/4W, 5%, 3.9 KILOHM	4010025-392
*R 145	RESISTOR, CARBON, 1/4W, 5%, 100 KILOHM	4010025-104
R 146	RESISTOR, CARBON, 1/4W, 5%, 4.7 KILOHM	4010025-472
R 147	RESISTOR, CARBON, 1/4W, 5%, 51 KILOHMS	4010025-513
R 148	RESISTOR, CARBON, 1/4W, 5%, 3.3 KILOHM	4010025-332

Table 4-4a. Video Board Replacement Parts (S/N 1-, 2- or 3-0075 or Lower) (Cont.)

CIRCUIT REF.	DESCRIPTION	COHU PART NO.
R 149	RESISTOR, CARBON, 1/4W, 5%, 220 KILOHMS	4010025-224
**R 150	RESISTOR, VARIABLE, 1 MEG OHM	5010097-002
RT 1	THERMISTOR	4910004-001
RV 1	VARISTOR, 233 BNR-5-096	4910026-001
U 1	INTEGRATED CIRCUIT CA 3046	3610059-001
U 2	INTEGRATED CIRCUIT CA 3046	3610059-001
U 3	INTEGRATED CIRCUIT	3610108-001
U 4	INTEGRATED CIRCUIT, N5733A	3610078-001
U 5	INTEGRATED CIRCUIT, U6E772 3393	3610071-003
**R 30	RESISTOR, METAL OXIDE, 1/4W, 2%, 6.2 KILOHMS	0310111-622
**C 7	CAPACITOR, TANTALUM, 3.3UF, 35V, 20%	0510151-016
**C 54	CAPACITOR, FILM DIELECTRIC, .022UF, 100V, 20%	0510136-223
**R 145	RESISTOR, CARBON, FILM, 1/4W, 5%, 220 KILOHMS	4010025-224
**L 1	INDUCTOR, VARIABLE, 1.98-2.42UH	2310056-010
**R 12	RESISTOR, CARBON FILM, 1/4W, 5%, 3.3 KILOHMS	4010025-332
**R 14	RESISTOR, CARBON FILM, 1/4W, 5%, 470 KILOHMS	4010025-474
*USED IN UNITS WITH SERIAL NUMBER 1-, 2- OR 3-0026 THROUGH 1-, 2- OR 3-0075 **USED IN UNITS WITH SERIAL NUMBER 1-, 2- OR 3-0001 THROUGH 1-, 2- OR 3-0025		

Table 4-4b. Video Board Replacement Parts (S/ N 1-, 2- or 3-0076 and ON)

CIRCUIT REF.	DESCRIPTION	COHU PART NO.
A 2	FILTER BOARD ASSY	8459111-032
C 3	CAPACITOR, CERAMIC .05UF 50V	0410009-503
C 4	CAPACITOR, CERAMIC .05UF 50V	0410009-503
C 6	CAPACITOR, CERAMIC .05UF 50V	0410009-503
C 7	CAPACITOR, TANTALUM, SELECT IN TEST	0510151-
C 10	CAPACITOR, TANTALUM, 22UF, 15V	0510151-037
C 11	CAPACITOR, SILVER MICA, 68PF, 500V	1010006-680
C 12	CAPACITOR, CERAMIC DISC, 470PF, 1KV	0401038
C 13	CAPACITOR, TANTALUM, 22UF, 15V	0510151-037
C 14	CAPACITOR, SILVER, MICA 120PF 100V	1010005-121
C 16	CAPACITOR, CERAMIC DISC, 470PF, 1KV	0401038
C 17	CAPACITOR, TANTALUM, 22UF, 15V	0510151-037
C 18	CAPACITOR, CERAMIC .05UF 50V	0410009-503
C 19	CAPACITOR, TANTALUM, 20%, 4.7UF, 35V	0510155-006
C 20	CAPACITOR, CERAMIC .05UF 50V	0410009-503
C 21	CAPACITOR, FILM, 0.01MFD, 100V	0610136-103
C 22	CAPACITOR, FILM, 0.22MFD, 100V	0610136-224
C 23	CAPACITOR, CERAMIC DISC, 20%, 30PF, 1KV	0401012
C 24	CAPACITOR, TANTALUM, 15 UF, 20V	0510151-032
C 33	CAPACITOR, CERAMIC .05UF 50V	0410009-503
C 34	CAPACITOR, TANTALUM, 20% 150UF, 15V	0510155-001
C 35	CAPACITOR, CERAMIC .05UF 50V	0410009-503
C 36	CAPACITOR, TANTALUM, 20% 150UF, 15V	0510155-001
C 37	CAPACITOR, VARIABLE, 5-25PF	0910002-001
C 38	CAPACITOR, CERAMIC DISC, 10PF, 1KV	0401004
C 39	CAPACITOR, CERAMIC .05UF 50V	0410009-503
C 40	CAPACITOR, CERAMIC .05UF 50V	0410009-503
C 41	CAPACITOR, CERAMIC .05UF 50V	0410009-503
C 42	CAPACITOR, TANTALUM, 22UF, 15V	0510151-037
C 45	CAPACITOR ELECTROLYTIC 50UF 25V	0510147-043
C 46	CAPACITOR, SILVER MICA	1010005-101
C 47	CAPACITOR ELECTROLYTIC 50UF 25V	0510147-043
C 51	CAPACITOR, FILM, .10UF, 100V	0610136-104
C 52	CAPACITOR, MYLAR, 0.47MFD, 100V	0610136-474
C 53	CAPACITOR, FILM, 0.047MFD, 100V	0610136-473
C 54	CAPACITOR, MYLAR, 0.068MFD, 100V	0610136-683
C 55	CAPACITOR, CERAMIC .05UF 50V	0410009-503
C 56	CAPACITOR, SILVER MICA, 220PF, 500V	1010006-221
C 57	CAPACITOR, CERAMIC DISC, .001UF, 500V	0401046
C 58	CAPACITOR, TANTALUM, 20% 150UF, 15V	0510155-001
CR 1	DIODE, ZENER, TYPE SZ6.8	3510049-021
CR 2	DIODE, ZENER, TYPE SZ6.8	3510049-021
CR 3	DIODE SWITCH TYPE 1N4148	3510042-029
CR 4	DIODE SWITCH TYPE 1N4148	3510042-029
CR 6	DIODE, ZENER, 12V, 1N4742	3510036-052
CR 9	DIODE SWITCH TYPE 1N4148	3510042-029
CR 10	DIODE SWITCH TYPE 1N4148	3510042-029
CR 11	DIODE, ZENER, TYPE HR2.8	3510036-015
K 1	RELAY, DPDT, 5V, 50 OHM	3710076-001
L 1	INDUCTOR, VARIABLE, .90-1.10UH	2310056-013
L 2	INDUCTOR, VARIABLE, 1.98-2.42 UH	2310056-010
LDR 61	PHOTO RESISTOR, TYPE, VTL202	4910027-001

Table 4-4b. Video Board Replacement Parts (S/N 1-, 2- or 3-0076 and ON) (Cont.)

CIRCUIT REF.		DESCRIPTION	COHU PART NO.
Q	1	TRANSISTOR, TYPE 2N3563	7210068-005
Q	2	TRANSISTOR, TYPE 2N2905	7210090-002
Q	3	TRANSISTOR, TYPE 2N4124	7210072-002
Q	4	TRANSISTOR, TYPE 2N4125	7210064-009
Q	5	TRANSISTOR, TYPE 2N4125	7210064-009
Q	5	TRANSISTOR, TYPE 2N4126	7210072-003
Q	6	TRANSISTOR, TYPE VCR 3P	7210105-001
Q	7	TRANSISTOR, TYPE 2N4124	7210072-002
Q	8	TRANSISTOR, TYPE 2N4126	7210072-003
Q	9	TRANSISTOR, TYPE 2N3646	7210068-001
Q	10	TRANSISTOR, TYPE 2N3646	7210068-001
Q	11	TRANSISTOR, TYPE 2N4126	7210072-003
Q	12	TRANSISTOR, TYPE 2N4124	7210072-002
Q	13	TRANSISTOR, TYPE 2N4126	7210072-003
Q	14	TRANSISTOR, TYPE 2N4124	7210072-002
Q	15	TRANSISTOR, TYPE 2N4126	7210072-003
Q	16	TRANSISTOR, TYPE 2N4126	7210072-003
Q	17	TRANSISTOR, TYPE 2N4126	7210072-003
Q	18	TRANSISTOR, TYPE 2N4124	7210072-002
Q	19	TRANSISTOR, TYPE 2N4124	7210072-002
Q	20	TRANSISTOR, TYPE 2N4124	7210072-002
Q	21	TRANSISTOR, TYPE 2N4124	7210072-002
Q	22	TRANSISTOR, TYPE 2N4124	7210072-002
Q	23	TRANSISTOR, TYPE 2N4124	7210072-002
Q	24	TRANSISTOR, TYPE 2N4124	7210072-002
Q	25	TRANSISTOR, TYPE 2N4124	7210072-002
Q	26	TRANSISTOR, TYPE 2N4126	7210072-003
Q	27	TRANSISTOR, FIELD EFFECT, TYPE 2N4303	7210082-002
Q	28	TRANSISTOR, TYPE 2N5400	7210085-003
Q	29	TRANSISTOR, TYPE 2N5400	7210085-003
Q	30	TRANSISTOR, TYPE 2N5400	7210085-003
Q	41	TRANSISTOR, TYPE 2N5551	7210072-007
Q	42	TRANSISTOR, TYPE 2N4124	7210072-002
Q	61	TRANSISTOR, TYPE 2N3646	7210068-001
Q	62	TRANSISTOR, TYPE 2N4124	7210072-002
Q	63	TRANSISTOR, TYPE 2N4124	7210072-002
Q	64	TRANSISTOR, TYPE 2N3563	7210068-005
Q	65	TRANSISTOR, TYPE 2N2905	7210090-002
Q	66	TRANSISTOR, TYPE 2N3646	7210068-001
Q	67	TRANSISTOR, TYPE 2N4126	7210072-003
Q	68	TRANSISTOR, TYPE 2N4124	7210072-002
Q	69	TRANSISTOR, TYPE 2N4124	7210072-002
Q	70	TRANSISTOR, TYPE 2N4124	7210072-002
R	1	RESISTOR, CARBON, 1/4W, 5% 1 KILOHM	4010025-102
R	2	RESISTOR, CARBON, 1/4W, 5%, 1.3 KILOHM	4010025-132
R	3	RESISTOR, VARIABLE, .5W, 500 OHM	5010097-001
R	5	RESISTOR, 1/2 WATT, 5%, 47 OHM	0310030-470
R	6	RESISTOR, VARIABLE, .5W, 1 KILOHM	5010097-003
R	7	RESISTOR, COMP, 1/2W, 5%, 430 OHM	0310030-431
R	8	RESISTOR, CARBON, 1/4W, 5%, 82 OHMS	4010025-820
R	9	RESISTOR, CARBON, 1/4W, 5%, 100 OHMS	4010025-101
R	10	RESISTOR, CARBON, 1/4W, 5%, 180 OHMS	4010025-181

Table 4-4b. Video Board Replacement Parts (S/N 1-, 2- or 3-0076 and ON) (Cont.)

CIRCUIT REF.	DESCRIPTION	COHU PART NO.
R 11	RESISTOR, CARBON, 1/4W, 5%, 2.2 KILOHM	4010025-222
R 12	RESISTOR, VARIABLE, .5W, 100 KILOHM	5010097-011
R 13	RESISTOR, VARIABLE, .5W, 50 KILOHM	5010097-012
R 14	RESISTOR, CARBON, 1/4W, 5%, 100 KILOHM	4010025-104
R 15	RESISTOR, 22 GAGE WIRE	7610032-999
R 16	RESISTOR, CARBON, 1/4W, 5%, 3.3 KILOHM	4010025-332
R 17	RESISTOR, CARBON, 1/4W, 5%, 2.7 KILOHM	4010025-272
R 18	RESISTOR, CARBON, 1/4W, 5%, 220 OHM	4010025-221
R 19	RESISTOR, CARBON, 1/4W, 5%, 22 OHM	4010025-220
R 21	RESISTOR, CARBON, 1/4W, 5%, 220 OHM	4010025-221
R 22	RESISTOR, CARBON, 1/4W, 5%, 75 OHMS	4010025-750
R 22	RESISTOR, VARIABLE, 1/2W 500 OHM, 20%	5010120-501
R 23	RESISTOR, CARBON, 1/4W, 5%, 1 KILOHM	4010025-102
R 23	RESISTOR, CARBON, 1/4W, 5%, 75 OHMS	4010025-750
R 24	RESISTOR, CARBON, 1/4W, 5%, 100 KILOHM	4010025-104
R 24	RESISTOR, VARIABLE, 10 KILOHM	5010135-103
R 25	RESISTOR, CARBON, 1/4W, 5%, 10 KILOHM	4010025-103
R 25	RESISTOR, CARBON, 1/4W, 5%, 75 OHMS	4010025-750
R 26	RESISTOR, CARBON, 1/4W, 5%, 560 OHM	4010025-561
R 27	RESISTOR, 1/2 WATT, 5%, 180 OHM	0310030-181
R 28	RESISTOR, VARIABLE, 1/2W, 1K, 20%	5010120-102
R 29	RESISTOR, CARBON, 1/4W, 5%, 220 OHM	4010025-221
R 31	RESISTOR, CARBON, 1/4W, 5%, 10 KILOHM	4010025-103
R 32	RESISTOR, CARBON, 1/4W, 5%, 220 OHM	4010025-221
R 33	RESISTOR, CARBON, 1/4W, 5%, 510 OHM	4010025-511
R 34	RESISTOR, CARBON, 1/4W, 5%, 220 OHM	4010025-221
R 35	RESISTOR, CARBON, 1/4W, 5%, 510 OHM	4010025-511
R 36	RESISTOR, CARBON, 1/4W, 5%, 1 KILOHM	4010025-102
R 37	RESISTOR, CARBON, 1/4W, 5%, 100 OHMS	4010025-101
R 38	RESISTOR, VARIABLE, 1 KILOHM	5010135-102
R 39	RESISTOR, VARIABLE, 5 KILOHM	5010135-502
R 41	RESISTOR, CARBON, 1/4W, 5%, 680 KILOHM	4010025-684
R 42	RESISTOR, CARBON, 1/4W, 5%, 4.7 KILOHM	4010025-472
R 43	RESISTOR, CARBON, 1/4W, 5%, 2.2 KILOHM	4010025-222
R 44	RESISTOR, CARBON, 1/4W, 5%, 1 KILOHM	4010025-102
R 45	RESISTOR, CARBON, 1/4W, 5%, 10 KILOHM	4010025-103
R 46	RESISTOR, CARBON, 1/4W, 5%, 470 OHM	4010025-471
R 47	RESISTOR, CARBON, 1/4W, 5%, 100 OHMS	4010025-101
R 48	RESISTOR, CARBON, 1/4W, 5%, 2.2 KILOHM	4010025-222
R 49	RESISTOR, CARBON, 1/4W, 5%, 100 OHMS	4010025-101
R 49	RESISTOR, VARIABLE, 20 KILOHM	5010135-203
R 50	RESISTOR, CARBON, 1/4W, 5%, 33 KILOHM	4010025-333
R 51	RESISTOR, CARBON, 1/4W, 5%, 4.7 KILOHM	4010025-472
R 52	RESISTOR, CARBON, 1/4W, 5%, 5.6 KILOHM	4010025-562
R 52	RESISTOR, CARBON, 1/4W, 5%, 8.2 KILOHMS	4010025-822
R 53	RESISTOR, CARBON, 1/4W, 5%, 100 OHMS	4010025-101
R 54	RESISTOR, CARBON, 1/4W, 5%, 22 KILOHM	4010025-223
R 55	RESISTOR, CARBON, 1/4W, 5%, 220 KILOHM	4010025-224
R 56	RESISTOR, CARBON, 1/4W, 5%, 1 KILOHM	4010025-102
R 57	RESISTOR, VARIABLE, 1/2W, 5K OHM 20%	5010120-502
R 58	RESISTOR, METAL OXIDE, 1/4W, 2% 820 OHM	0310111-821
R 59	RESISTOR, CARBON, 1/4W, 5%, 470 OHM	4010025-471

Table 4-4b. Video Board Replacement Parts (S/N 1-, 2- or 3-0076 and ON) (Cont.)

CIRCUIT REF.	DESCRIPTION	COHU PART NO.
R 60	RESISTOR, CARBON, 1/4W, 5%, 3.3 KILOHM	4010025-332
R 61	RESISTOR, METAL OXIDE, 1/4W, 2%, 560 OHM	0310111-561
R 62	RESISTOR, CARBON, 1/4W, 5%, 4.7 KILOHM	4010025-472
R 62	RESISTOR, CARBON, 1/4W, 5%, 820 OHMS	4010025-821
R 63	RESISTOR, METAL OXIDE, 1/4W, 2%, 1.5 KIL OHM	0310111-152
R 64	RESISTOR, CARBON, 1/4W, 5%, 6.8 KILOHM	4010025-682
R 65	RESISTOR, CARBON, 1/4W, 5% 1 KILOHM	4010025-102
R 66	RESISTOR, CARBON, 1/4W, 5%, 100 OHMS	4010025-101
R 66	RESISTOR, CARBON, 1/4W, 5%, 820 OHMS	4010025-821
R 67	RESISTOR, CARBON, 1/4W, 5% 1 KILOHM	4010025-102
R 68	RESISTOR, CARBON, 1/4W, 5%, 4.7 KILOHM	4010025-472
R 69	RESISTOR, CARBON, 1/4W, 5%, 3.3 KILOHM	4010025-332
R 70	RESISTOR, CARBON, 1/4W, 5%, 10 KILOHM	4010025-103
R 71	RESISTOR, CARBON, 1/4W, 5% 1 KILOHM	4010025-102
R 72	RESISTOR, CARBON, 1/4W, 5%, 560 OHM	4010025-561
R 73	RESISTOR, VARIABLE, .5W, 1 KILOHM	5010097-003
R 74	RESISTOR, CARBON, 1/4W, 5%, 4.7 KILOHM	4010025-472
R 75	RESISTOR, CARBON, 1/4W, 5%, 1.8 KILOHM	4010025-182
R 76	RESISTOR, CARBON, 1/4W, 5%, 1.5 KILOHM	4010025-152
R 77	RESISTOR, CARBON, 1/4W, 5%, 3.3 KILOHM	4010025-332
R 78	RESISTOR, PRECISION, 1%, 75 OHM	4710036-017
R 78	RESISTOR, VARIABLE, 1/2W 500 OHM, 20%	5010120-501
R 79	RESISTOR, CARBON, 1/4W, 5%, 3.3 KILOHM	4010025-332
R 79	RESISTOR, PRECISION, 1%, 75 OHM	4710036-017
R 81	RESISTOR, CARBON, 1/4W, 5%, 3.3 KILOHM	4010025-332
R 82	RESISTOR, CARBON, 1/4W, 5%, 1.8 KILOHM	4010025-182
R 83	RESISTOR, CARBON, 1/4W, 5%, 15 KILOHM	4010025-153
R 84	RESISTOR, CARBON, 1/4W, 5%, 100 OHMS	4010025-101
R 85	RESISTOR, CARBON, 1/4W, 5%, 1.5 KILOHM	4010025-152
R 86	RESISTOR, VARIABLE, .5W, 1 KILOHM	5010097-003
R 87	RESISTOR, CARBON, 1/4W, 5%, 6.8 KILOHM	4010025-682
R 88	RESISTOR, CARBON, 1/4W, 5%, 4.7 KILOHM	4010025-472
R 89	RESISTOR, CARBON, 1/4W, 5%, 3.3 KILOHM	4010025-332
R 90	RESISTOR, CARBON, 1/4W, 5%, 330 OHM	4010025-331
R 91	RESISTOR, CARBON, 1/4W, 5%, 56 OHM	4010025-560
R 92	RESISTOR, CARBON, 1/4W, 5%, 56 OHM	4010025-560
R 93	RESISTOR, VARIABLE, .5W, 500 OHM	5010097-001
R 93	RESISTOR, VARIABLE, 10 KILOHM	5010135-103
R 94	RESISTOR, CARBON, 1/4W, 5% 1 KILOHM	4010025-102
R 95	RESISTOR, CARBON, 1/4W, 5%, 100 OHMS	4010025-101
R 96	RESISTOR, CARBON, 1/4W, 5%, 10 KILOHM	4010025-103
R 97	RESISTOR, CARBON, 1/4W, 5%, 10 OHMS	4010025-100
R 98	RESISTOR, 1/2 WATT, 5%, 330 OHM	0310030-331
R 98	RESISTOR, CARBON, 1/4W, 5%, 680 KILOHM	4010025-684
R 99	RESISTOR, CARBON, 1/4W, 5%, 68 OHM	4010025-680
R 100	RESISTOR, CARBON, 1/4W, 5%, 68 OHM	4010025-680
R 101	RESISTOR, CARBON, 1/4W, 5% 1 KILOHM	4010025-102
R 102	RESISTOR, CARBON, 1/4W, 5% 1 KILOHM	4010025-102
R 103	RESISTOR, CARBON, 1/4W, 5%, 82 OHMS	4010025-820
R 104	RESISTOR, CARBON, 1/4W, 5%, 470 OHM	4010025-471
R 105	RESISTOR, VARIABLE, 1/2W, 1K, 20%	5010120-102
R 106	RESISTOR, CARBON, 1/4W, 5% 1 KILOHM	4010025-102

Table 4-4b. Video Board Replacement Parts (S/ N 1-, 2- or 3-0076 and ON) (Cont.)

CIRCUIT REF.	DESCRIPTION	COHU PART NO.
R 107	RESISTOR, CARBON, 1/4W, 5%, 33 KILOHM	4010025-333
R 108	RESISTOR, CARBON, 1/4W, 5%, 220 OHM	4010025-221
R 109	RESISTOR, CARBON, 1/4W, 5%, 4.7 KILOHM	4010025-472
R 110	RESISTOR, CARBON, 1/4W, 5%, 6.8 KILOHM	4010025-682
R 115	RESISTOR, 1/2 WATT, 5%, 120 OHM	0310030-121
R 116	RESISTOR, CARBON, 1/4W, 5%, 4.7 OHM	4045000-047
R 117	RESISTOR, PRECISION, 1%, 2.74 KILOHM	4710036-011
R 118	RESISTOR, PRECISION, 1%, 6.81 KILOHM	4710036-035
R 131	RESISTOR, CARBON, 1/4W, 5%, 3.3 KILOHM	4010025-332
R 132	RESISTOR, CARBON, 1/4W, 5%, 3.3 KILOHM	4010025-332
R 133	RESISTOR, CARBON, 1/4W, 5%, 4.7 KILOHM	4010025-472
R 134	RESISTOR, CARBON, 1/4W, 5%, 4.7 KILOHM	4010025-472
R 135	RESISTOR, CARBON, 1/4W, 5%, 2.2 KILOHM	4010025-222
R 137	RESISTOR, CARBON, 1/4W, 5%, 3.3 KILOHM	4010025-332
R 138	RESISTOR, CARBON, 1/4W, 5%, 68 KILOHM	4010025-683
R 139	RESISTOR, CARBON, 1/4W, 5% 1 KILOHM	4010025-102
R 140	RESISTOR, CARBON, 1/4W, 5%, 330 KILOHM	4010025-334
R 141	RESISTOR, CARBON, 1/4W, 5%, 330 KILOHM	4010025-334
R 142	RESISTOR, CARBON, 1/4W, 5%, 1.0 MEGOHM	4045000-105
R 143	RESISTOR, CARBON, 1/4W, 5%, 3.3 KILOHM	4010025-332
R 144	RESISTOR, CARBON, 1/4W, 5%, 3.9 KILOHM	4010025-392
R 145	RESISTOR, CARBON, 1/4W, 5%, 100 KILOHM	4010025-104
R 146	RESISTOR, CARBON, 1/4W, 5%, 4.7 KILOHM	4010025-472
R 147	RESISTOR, CARBON, 1/4W, 5%, 68 KILOHM	4010025-683
R 148	RESISTOR, CARBON, 1/4W, 5%, 3.3 KILOHM	4010025-332
R 149	RESISTOR, CARBON, 1/4W, 5%, 220 KILOHM	4010025-224
R 150	RESISTOR, CARBON, 1/4W, 5%, 68 KILOHM	4010025-683
R 151	RESISTOR, VARIABLE, 1 MEG OHM	5010097-002
R 153	RESISTOR, VARIABLE, .5W, 10 KILOHM	5010097-006
R 154	RESISTOR, CARBON, 1/4W, 5%, 10 OHMS	4010025-100
RT 1	THERMISTOR	4910004-001
RT 41	THERMISTOR, L1215-300K-152-S4	4910005-001
RV 1	RESISTOR, VARISTOR, 1/8W, 233BNR-5-096	4910026-001
RV 41	RESISTOR, VARISTOR, 1/8W, 233BNR-5-096	4910026-001
U 1	INTEGRATED CIRCUIT CA 3046	3610059-001
U 2	INTEGRATED CIRCUIT CA 3046	3610059-001
U 3	INTEGRATED CIRCUIT	3610108-001
U 4	INT. CKT, VIDEO DIFF AMP, TYPE N5733A	3610078-001
U 5	INT. CKT, VOLTAGE REGULATOR, TYPE UA723C	3610071-003

Table 4-5. Replacement Parts, 8455801 Deflection Board (S/ N 8-0001 and ON)

CIRCUIT REF.		DESCRIPTION	COHU PART NO.
C	1	CAPACITOR, SILVER MICA, 82PF, 500V	1010006-820
C	2	CAPACITOR, CERAMIC DISC, 68PF, 1KV	0401018-
C	3	CAPACITOR, FILM, 0.01MFD, 100V	0610136-103
C	4	CAPACITOR, FILM, .10UF, 100V	0610136-104
C	5	CAPACITOR, MYLAR, .033UF, 20%, 50V	0610133-032
C	6	CAPACITOR, SILVER MICA 330PF 500V	1010006-331
C	7	CAPACITOR, 270PF, 5%, 500V	1010006-271
C	8	CAPACITOR MYLAR 1UF 100V	0610150-105
C	9	CAPACITOR, FILM, 0.01MFD, 100V	0610136-103
C	11	CAPACITOR, MYLAR, .0033 UF, 400V	0610133-004
C	12	CAPACITOR, MYLAR .001UF 400V	0610133-001
C	13	CAPACITOR, FILM .022UF 100V	0610136-223
C	14	CAPACITOR ELECTROLYTIC 50UF 25V	0510147-043
C	15	CAPACITOR MYLAR 1UF 100V	0610150-105
C	16	CAPACITOR ELECTROLYTIC 50UF 25V	0510147-043
C	17	CAPACITOR ELECTROLYTIC 50UF 25V	0510147-043
C	18	CAPACITOR MYLAR 1UF 100V	0610150-105
C	21	CAPACITOR ELECTROLYTIC 50UF 25V	0510147-043
C	22	CAPACITOR, FILM .015UF 100V	0610136-154
C	23	CAPACITOR, FILM .022UF 100V	0610136-223
C	24	CAPACITOR, MYLAR, 0.47MFD, 100V	0610136-474
C	25	CAPACITOR, MYLAR .001UF 400V	0610133-001
C	27	CAPACITOR, FILM, 0.01MFD, 100V	0610136-103
C	28	CAPACITOR, FILM .022UF 100V	0610136-223
C	29	CAPACITOR, FILM, .10UF, 100V	0610136-104
C	30	CAPACITOR, FILM, .10UF, 100V	0610136-104
C	32	CAPACITOR MYLAR 1UF 100V	0610150-105
C	34	CAPACITOR, CERAMIC DISC, .01 UF, 200V	0407316-007
C	35	CAPACITOR, CERAMIC DISC, .01 UF, 200V	0407316-007
C	36	CAPACITOR, CERAMIC DISC, .01 UF, 200V	0407316-007
CR	1	DIODE, SILICON, TYPE 1N916	3510042-027
CR	2	DIODE, SILICON, TYPE 1N916	3510042-027
CR	3	DIODE, SILICON, TYPE 1N457	3510042-022
CR	4	DIODE, SILICON, TYPE 1N457	3510042-022
L	1	COIL, 2.2 UH	2310029-023
Q	1	TRANSISTOR TYPE 2N5486	7210084-002
Q	2	TRANSISTOR, TYPE 2N3638	7210069-001
Q	3	TRANSISTOR TYPE 2N5486	7210084-002
Q	4	TRANSISTOR, TYPE 2N3646	7210068-001
Q	5	DUAL TRANSISTOR, SILICON	7210096-001
R	1	RESISTOR, CARBON, 1/4W, 5%, 10 KILOHM	4045000-103
R	2	RESISTOR, CARBON, 1/4W, 5%, 100 KILOHM	4045000-104
R	3	RESISTOR, CARBON, 1/4W, 5%, 3.3 KILOHM	4045000-332
R	6	RESISTOR, CARBON, 1/4W, 5%, 10 KILOHM	4045000-103
R	7	RESISTOR 5K	5010090-007
R	8	RESISTOR, CARBON, 1/4W, 5%, 2.7 KILOHM	4045000-272
R	11	RESISTOR, VARIABLE 25K	5010090-005
R	12	RESISTOR, CARBON, 1/4W, 5%, 2.2 KILOHM	4045000-222
R	13	RESISTOR, CARBON, 1/4W, 5%, 1.0 KILOHM	4045000-102
R	14	RESISTOR, CARBON, 1/4W, 5%, 22 KILOHM	4045000-223

Table 4-5. Replacement Parts, 8455801 Deflection Board (S/ N 8-0001 and ON) (Cont.)

CIRCUIT REF.	DESCRIPTION	COHU PART NO.
R 16	RESISTOR, VARIABLE, 100 KILOHM, 1/8W	5010090-009
R 17	RESISTOR, CARBON, 1/4W, 5%, 10 KILOHM	4045000-103
R 19	RESISTOR, CARBON, 1/4W, 5%, 270 KILOHM	4045000-274
R 21	RESISTOR, VARIABLE, 1/2W, 100K 20%	5010120-104
R 22	RESISTOR, CARBON, 1/4W, 5%, 10 KILOHM	4045000-103
R 23	RESISTOR, CARBON, 1/4W, 5%, 10 KILOHM	4045000-103
R 24	RESISTOR, CARBON, 1/4W, 5%, 10 KILOHM	4045000-103
R 26	RESISTOR, CARBON, 1/4W, 5%, 47 OHM	4045000-470
R 27	RESISTOR, VARIABLE, 1/2W, 10K 20%	5010120-103
R 28	RESISTOR, CARBON, 1/4W, 5%, 1.0 KILOHM	4045000-102
R 29	RESISTOR, CARBON, 1/4W, 5%, 330 OHM	4045000-331
R 30	RESISTOR, VARIABLE, 10 KILOHM, 1/8W	5010090-001
R 31	RESISTOR, CARBON, 1/4W, 5%, 470 OHM	4045000-471
R 32	RESISTOR, CARBON, 1/4W, 5%, 5.6 KILOHM	4045000-562
R 33	RESISTOR, CARBON, 1/4W, 5%, 1.5 KILOHM	4045000-152
R 34	RESISTOR, CARBON, 1/4W, 5%, 22 KILOHM	4045000-223
R 35	RESISTOR, VARIABLE, 1/2W, 1K, 20%	5010120-102
R 36	RESISTOR, METAL OXIDE, 1/4W, 2%, 560 OHM	0310111-561
R 37	RESISTOR, METAL OXIDE, 1/2W, 2%, 180 KILOHM	0310112-184
R 38	RESISTOR, CARBON, 1/4W, 5%, 15 KILOHM	4045000-153
R 39	RESISTOR, VARIABLE, 1/2W, 100K 20%	5010120-104
R 40	RESISTOR, VARIABLE, 200 OHM, 1/2W	5010120-201
R 41	RESISTOR, METAL OXIDE, 1/4W, 2%, 47 OHM	0310111-470
R 43	RESISTOR, CARBON, 1/4W, 5%, 270 OHM	4045000-271
R 44	RESISTOR, CARBON, 1/4W, 5%, 10 KILOHM	4045000-103
R 45	RESISTOR, CARBON, 1/4W, 5%, 10 KILOHM	4045000-103
R 46	RESISTOR, CARBON, 1/4W, 5%, 680 OHM	4045000-681
R 47	RESISTOR, CARBON, 1/4W, 5%, 10 OHM	4045000-100
R 48	RESISTOR, CARBON, 1/4W, 5%, 10 OHM	4045000-100
R 49	RESISTOR, CARBON, 1/4W, 5%, 1.0 KILOHM	4045000-102
R 50	RESISTOR, CARBON, 1/4W, 5%, 120 KILOHM	4045000-124
R 51	RESISTOR, VARIABLE, 1/2W, 100K 20%	5010120-104
R 52	RESISTOR, CARBON, 1/4W, 5%, 39 KILOHM	4045000-393
R 53	RESISTOR, CARBON, 1/4W, 5%, 1.5 KILOHM	4045000-152
R 55	RESISTOR, 1/2 WATT, 5%, 100 OHM	0310030-101
R 56	RESISTOR, CARBON, 1/4W, 5%, 12 MEGOHM	4045000-126
R 57	RESISTOR, VARIABLE, .5W, 10 KILOHM	5010097-006
R 58	RESISTOR, CARBON, 1/4W, 5%, 1.0 MEGOHM	4045000-105
R 59	RESISTOR, CARBON, 1/4W, 5%, 1.0 MEGOHM	4045000-105
R 61	RESISTOR, CARBON, 1/4W, 5%, 3.9 KILOHM	4045000-392
R 62	RESISTOR, CARBON, 1/4W, 5%, 15 MEGOHM	4045000-156
R 63	RESISTOR, VARIABLE, .5W, 10 KILOHM	5010097-006
R 64	RESISTOR, CARBON, 1/4W, 5%, 1.2 KILOHM	4045000-122
R 66	RESISTOR, CARBON, 1/4W, 5%, 390 OHM	4045000-391
R 67	RESISTOR, CARBON, 1/4W, 5%, 390 OHM	4045000-391
R 68	RESISTOR, 1/2 WATT, 5%, 1.8 KILOHM	0310030-182
R 69	RESISTOR, CARBON, 1/4W, 5%, 22 MEGOHM	4045000-226
R 71	RESISTOR, CARBON, 1/4W, 5%, 1.0 KILOHM	4045000-102
R 72	RESISTOR, CARBON, 1/4W, 5%, 180 OHM	4045000-181
R 73	RESISTOR, CARBON, 1/4W, 5%, 18 KILOHM	4045000-183

Table 4-5. Replacement Parts, 8455801 Deflection Board (S/N 8-0001 and ON) (Cont.)

CIRCUIT REF.	DESCRIPTION	COHU PART NO.
R 74	RESISTOR, CARBON, 1/4W, 5%, 2.7 KILOHM	4045000-272
**R 76	RESISTOR, CARBON, 1/4W, 5%, 10 MEGOHM	4045000-106
U 1	INT. CIRCUIT QUAD 2-INPUT GATE, MC7400P	3610084-001
U 2	INTEGRATED CIRCUIT, QUAD 2-INPUT GATE	3610015-001
U 3	INTEGRATED CIRCUIT	3610059-001
U 4	INT. CIRCUIT AMP. μ A741C	3610072-001
U 5	INT. CIRCUIT MONOSTABLE MV, SN74121N	3610090-001
U 6	INT. CIRCUIT AMPLIFIER, CA3047A	3610092-001
**R 76	RESISTOR, CARBON, 1/4W, 5%, 100 KILOHM	4045000-104
**R 77	RESISTOR, CARBON, 1/4W, 5%, 100 KILOHM	4045000-104
**R 78	RESISTOR, CARBON, 1/4W, 5%, 100 KILOHM	4045000-104
**R 79	RESISTOR, CARBON, 1/4W, 5%, 100 KILOHM	4045000-104
**R 80	RESISTOR, CARBON, 1/4W, 5%, 100 KILOHM	4045000-104
**C 37	CAPACITOR, FILM, 0.33 MFD, 100V	0610136-334
*USED IN UNITS WITH S/N 8-0001 THROUGH 8-0050 ONLY **USED IN UNITS WITH S/N 8-0051 AND ON		

Table 4-6. Replacement Parts, 8455901 Deflection Board (S/ N 9-0001 and ON)

CIRCUIT REF.	DESCRIPTION	COHU PART NO.
C 1	CAPACITOR, SILVER MICA, 2700PF, 500V	1010007-272
C 2	CAPACITOR, CERAMIC DISC, 68PF, 1KV	0401018
C 3	CAPACITOR, SILVER MICA, 2200PF, 500V	1010007-222
C 4	CAPACITOR, FILM, 0.047MFD, 100V	0610136-473
C 5	CAPACITOR, FILM .033UF 100V	0610136-333
C 6	CAPACITOR, SILVER MICA 330PF 500V	1010006-331
C 7	CAPACITOR, SILVER MICA, 270 PF, 5%, 500V	1010006-271
C 8	CAPACITOR MYLAR 1UF 100V	0610150-105
C 9	CAPACITOR, FILM, .10UF, 100V	0610136-104
C 11	CAPACITOR, FILM, 0.01MFD, 100V	0610136-103
C 12	CAPACITOR, MYLAR .001UF 400V	0610133-001
C 13	CAPACITOR, FILM .022UF 100V	0610136-223
C 14	CAPACITOR ELECTROLYTIC 50UF 25V	0510147-043
C 15	CAPACITOR MYLAR 1UF 100V	0610150-105
C 16	CAPACITOR ELECTROLYTIC 50UF 25V	0510147-043
C 17	CAPACITOR ELECTROLYTIC 50UF 25V	0510147-043
C 18	CAPACITOR MYLAR 1UF 100V	0610150-105
C 21	CAPACITOR ELECTROLYTIC 50UF 25V	0510147-043
C 22	CAPACITOR, FILM .015UF 100V	0610136-154
C 23	CAPACITOR, FILM .022UF 100V	0610136-223
C 24	CAPACITOR, MYLAR, 0.47MFD, 100V	0610136-474
C 25	CAPACITOR, MYLAR .001UF 400V	0610133-001
C 27	CAPACITOR, FILM, 0.01MFD, 100V	0610136-103
C 28	CAPACITOR, FILM .022UF 100V	0610136-223
C 29	CAPACITOR, FILM, .10UF, 100V	0610136-104
C 30	CAPACITOR, FILM, .10UF, 100V	0610136-104
C 32	CAPACITOR MYLAR 1UF 100V	0610150-105
C 34	CAPACITOR, CERAMIC DISC, .01 UF, 200V	0407316-007
C 35	CAPACITOR, CERAMIC DISC, .01 UF, 200V	0407316-007
C 36	CAPACITOR, CERAMIC DISC, .01 UF, 200V	0407316-007
C 38	CAPACITOR, CERAMIC .05UF 50V	0410009-503
C 39	CAPACITOR, MYLAR, 0.47MFD, 100V	0610136-474
C 40	CAPACITOR, TANTALUM 10UF 20V	0510151-028
C 41	CAPACITOR, CERAMIC .05UF 50V	0410009-503
C 42	CAPACITOR, CERAMIC .05UF 50V	0410009-503
CR 1	DIODE, SILICON, TYPE 1N916	3510042-027
CR 2	DIODE, SILICON, TYPE 1N916	3510042-027
CR 3	DIODE, SILICON, TYPE 1N457	3510042-022
CR 4	DIODE, SILICON, TYPE 1N457	3510042-022
CR 5	DIODE SWITCH TYPE 1N4148	3510042-029
CR 6	DIODE, ZENER, TYPE 1N4745A	3510036-039
CR 7	DIODE SWITCH TYPE 1N4148	3510042-029
L 1	COIL, 2.2 UH	2310029-023
Q 1	TRANSISTOR, TYPE 2N3638	7210069-001
Q 2	TRANSISTOR TYPE 2N5486	7210084-002
Q 3	TRANSISTOR, TYPE 2N3646	7210068-001
Q 4	TRANSISTOR TYPE 2N5486	7210084-002
Q 5	TRANSISTOR, TYPE 2N4123	7210064-008
Q 6	TRANSISTOR, D602	7210096-001
Q 7	TRANSISTOR, TYPE 2N4123	7210064-008

Table 4-6. Replacement Parts, 8455901 Deflection Board (S/ N 9-0001 and ON) (Cont.)

CIRCUIT REF.		DESCRIPTION	COHU PART NO.
Q	8	TRANSISTOR, TYPE 2N4123	7210064-008
Q	9	TRANSISTOR, TYPE 2N4126	7210072-003
Q	10	TRANSISTOR, TYPE 2N4126	7210072-003
R	1	RESISTOR, CARBON, 1/4W, 5%, 10 KILOHM	4010025-103
R	2	RESISTOR, CARBON, 1/4W, 5%, 100 KILOHM	4010025-104
R	3	RESISTOR, CARBON, 1/4W, 5%, 3.3 KILOHM	4010025-332
R	6	RESISTOR, CARBON, 1/4W, 5%, 470 OHM	4010025-471
R	7	RESISTOR, CARBON, 1/4W, 5%, 470 OHM	4010025-471
R	8	RESISTOR, CARBON, 1/4W, 5%, 10 KILOHM	4010025-103
R	11	RESISTOR, VARIABLE 25 KILOHM	5010090-005
R	12	RESISTOR, CARBON, 1/4W, 5%, 2.1 KILOHM	4010025-222
R	13	RESISTOR, CARBON, 1/4W, 5%, 3.3 KILOHM	4010025-332
R	14	RESISTOR, VARIABLE, 500 OHMS	5010090-006
R	16	RESISTOR, CARBON, 1/4W, 5%, 680 OHM	4010025-681
R	17	RESISTOR, CARBON, 1/4W, 5%, 10 KILOHM	4010025-103
R	19	RESISTOR, METAL OXIDE, 1/4W, 2%, 47 OHMS	0310111-470
R	21	RESISTOR, VARIABLE, 1/2W 500 OHM, 20%	5010120-501
R	22	RESISTOR, CARBON, 1/4W, 5%, 270 KILOHMS	4010025-274
R	23	RESISTOR, CARBON, 1/4W, 5%, 4.7 KILOHM	4010025-472
R	24	RESISTOR, CARBON, 1/4W, 5%, 10 KILOHM	4010025-103
R	26	RESISTOR, CARBON, 1/4W, 5%, 47 OHMS	4010025-470
R	28	RESISTOR, CARBON, 1/4W, 5%, 1 KILOHM	4010025-102
R	29	RESISTOR, CARBON, 1/4W, 5%, 330 OHM	4010025-331
R	31	RESISTOR, CARBON, 1/4W, 5%, 470 OHM	4010025-471
R	32	RESISTOR, CARBON, 1/4W, 5%, 5.6 KILOHM	4010025-562
R	33	RESISTOR, CARBON, 1/4W, 5%, 1.5 KILOHM	4010025-152
R	34	RESISTOR, CARBON, 1/4W, 5%, 22 KILOHM	4010025-223
R	35	RESISTOR, VARIABLE, 1/2W, 1K, 20%	5010120-102
R	36	RESISTOR, METAL OXIDE, 1/4W, 2%, 560 OHMS	0310111-561
R	37	RESISTOR, METAL OXIDE, 1/2W, 2%, 180 KILOHMS	0310112-184
R	38	RESISTOR, CARBON, 1/4W, 5%, 15 KILOHM	4010025-153
R	39	RESISTOR, VARIABLE, 1/2W, 100K 20%	5010120-104
R	40	RESISTOR, VARIABLE, 1/2W, 20%, 200 OHMS	5010120-201
R	41	RESISTOR, METAL OXIDE, 1/4W, 2%, 47 OHMS	0310111-470
R	43	RESISTOR, CARBON, 1/4W, 5%, 270 OHMS	4010025-271
R	44	RESISTOR, CARBON, 1/4W, 5%, 10 KILOHM	4010025-103
R	45	RESISTOR, CARBON, 1/4W, 5%, 10 KILOHM	4010025-103
R	46	RESISTOR, CARBON, 1/4W, 5%, 680 OHM	4010025-681
R	47	RESISTOR, CARBON, 1/4W, 5%, 10 OHM	4010025-100
R	48	RESISTOR, CARBON, 1/4W, 5%, 10 OHM	4010025-100
R	49	RESISTOR, CARBON, 1/4W, 5%, 1 KILOHM	4010025-102
R	50	RESISTOR, CARBON, 1/4W, 5%, 120 KILOHMS	4010025-124
R	51	RESISTOR, VARIABLE, 1/2W, 100K 20%	5010120-104
R	52	RESISTOR, CARBON, 1/4W, 5%, 39 KILOHM	4010025-393
R	53	RESISTOR, CARBON, 1/4W, 5%, 1.5 KILOHM	4010025-152
R	55	RESISTOR, 1/2 WATT, 5%, 100 OHM	0310030-101
R	56	RESISTOR, CARBON, 1/4W, 5%, 12 MEGOHM	4045000-126
R	57	RESISTOR, VARIABLE, .5W, 10 KILOHM	5010097-006
R	58	RESISTOR, CARBON, 1/4W, 5%, 1 MEGOHM	4010025-105
R	59	RESISTOR, CARBON, 1/4W, 5%, 1 MEGOHM	4010025-105

Table 4-6. Replacement Parts, 8455901 Deflection Board (S/ N 9-0001 and ON) (Cont.)

CIRCUIT REF.	DESCRIPTION	COHU PART NO.
R 61	RESISTOR, CARBON, 1/4W, 5%, 3.9 KILOHM	4010025-392
R 62	RESISTOR, CARBON, 1/4W, 5%, 15 MEGOHM	4045000-156
R 63	RESISTOR, VARIABLE, .5W, 10 KILOHM	5010097-006
R 64	RESISTOR, CARBON, 1/4W, 5%, 1.2 KILOHMS	4010025-122
R 64	RESISTOR, CARBON, 1/4W, 5%, 22 MEGOHM	4045000-226
R 66	RESISTOR, CARBON, 1/4W, 5%, 390 OHMS	4010025-391
R 67	RESISTOR, CARBON, 1/4W, 5%, 390 OHMS	4010025-391
R 68	RESISTOR, 1/2 WATT, 5%, 1.8 KILOHM	0310030-182
R 71	RESISTOR, CARBON, 1/4W, 5%, 1 KILOHM	4010025-102
R 72	RESISTOR, CARBON, 1/4W, 5%, 180 OHMS	4010025-181
R 73	RESISTOR, CARBON, 1/4W, 5%, 18 KILOHMS	4010025-183
R 74	RESISTOR, CARBON, 1/4W, 5%, 2.7 KILOHMS	4010025-272
R 76	RESISTOR, CARBON, 1/4W, 5%, 1 KILOHM	4010025-104
R 77	RESISTOR, CARBON, 1/4W, 5%, 1 KILOHM	4010025-104
R 78	RESISTOR, CARBON, 1/4W, 5%, 1 KILOHM	4010025-104
R 79	RESISTOR, CARBON, 1/4W, 5%, 1 MEGOHM	4010025-105
R 81	RESISTOR, CARBON, 1/4W, 5%, 4.7 KILOHM	4010025-472
R 82	RESISTOR, CARBON, 1/4W, 5%, 1 KILOHM	4010025-102
R 83	RESISTOR, CARBON, 1/4W, 5%, 4.7 KILOHM	4010025-472
R 84	RESISTOR, CARBON, 1/4W, 5%, 560 KILOHMS	4010025-564
R 85	RESISTOR, CARBON, 1/4W, 5%, 2.2 KILOHM	4010025-222
R 86	RESISTOR, CARBON, 1/4W, 5%, 30 KILOHMS	4010025-303
R 87	RESISTOR, CARBON, 1/4W, 5%, 10 KILOHM	4010025-103
R 88	RESISTOR, CARBON, 1/4W, 5%, 10 KILOHM	4010025-103
R 89	RESISTOR, VARIABLE, .5W, 10 KILOHM	5010097-006
R 90	RESISTOR, VARIABLE, 1/2W, 10K 20%	5010120-103
R 91	RESISTOR, CARBON, 1/4W, 5%, 470 OHM	4010025-471
R 92	RESISTOR, CARBON, 1/4W, 5%, 1 KILOHM	4010025-102
R 93	RESISTOR, CARBON, 1/4W, 5%, 820 OHM	4010025-821
U 1	INTEGRATED CIRCUIT, SN7400N	3610084-001
U 2	INTEGRATED CIRCUIT SN-74121N	3610090-001
U 3	INTEGRATED CIRCUIT, 741P	3610108-001
U 4	INTEGRATED CIRCUIT, CA3047A	3610092-001
U 5	INTEGRATED CIRCUIT, QUAD 2-INPUT GATE MC824P	3610015-001
U 6	INTEGRATED CIRCUIT SN-74121N	3610090-001
U 7	INTEGRATED CIRCUIT 741P	3610108-001
U 8	INTEGRATED CIRCUIT, LM311D	3610131-001

Table 4-7. Replacement Parts, Power Supply (Dwg. D8454210D)

CIRCUIT REF.	DESCRIPTION	COHU PART NO.
A 4	POWER SUPPLY BOARD ASSY	8454211-001
C 1	CAPACITOR, ELECTROLYTIC, 1000MFD, 50V	0510148-511
C 2	CAPACITOR, CERAMIC DISC, 200PF, 1KV	0401027-
C 3	CAPACITOR ELECTROLYTIC 25UF 25V	0510152-021
C 4	CAPACITOR, ELECTROLYTIC, 1000MFD, 50V	0510148-511
C 5	CAPACITOR, CERAMIC DISC, 200PF, 1KV	0401027-
C 6	CAPACITOR ELECTROLYTIC 25UF 25V	0510152-021
C 7	CAPACITOR, ELECTROLYTIC, 1000UF, 25V	0510148-407
C 8	CAPACITOR, CERAMIC DISC, 200PF, 1KV	0401027-
C 9	CAPACITOR, CERAMIC DISC, 200PF, 1KV	0401027-
C 10	CAPACITOR ELECTROLYTIC 25UF 25V	0510152-021
C 11	CAPACITOR ELECTROLYTIC 25UF 25V	0510152-021
C 12	CAPACITOR, ELECTROLYTIC, 2UF, 450V	0510148-902
C 13	CAPACITOR, ELECTROLYTIC, 2UF, 450V	0510148-902
C 14	CAPACITOR, MYLAR .022UF 200V	0610133-011
*C 15	CAPACITOR, FILM, 1.0 UF, 35V	0610136-104
CR 1	DIODE RECTIFIER, MDA 970-2	3510087-001
CR 2	DIODE RECTIFIER, MDA 970-2	3510087-001
CR 3	DIODE RECTIFIER, MDA 970-2	3510087-001
CR 4	DIODE, RECTIFIER, TYPE ST-18	3510068-004
CR 5	DIODE, RECTIFIER, TYPE ST-18	3510068-004
CR 6	DIODE, RECTIFIER, TYPE ST-18	3510068-004
CR 7	DIODE, RECTIFIER, TYPE ST-18	3510068-004
**CR 8	DIODE TYPE VR100A	3510049-028
**CR 9	DIODE TYPE VR100A	3510049-028
**CR 10	DIODE TYPE VR100A	3510049-028
**CR 11	DIODE TYPE VR100A	3510049-028
R 2	RESISTOR, WIREWOUND, 1W, 1.5 OHM	5110032-015
R 3	RESISTOR, WIREWOUND, 1W, 1 OHM	5110032-010
R 4	RESISTOR, CARBON, 1/4W, 5%, 1.2 KILOHM	4045000-122
R 5	RESISTOR, CARBON, 1/4W, 5%, 3.3 KILOHM	4045000-332
R 6	RESISTOR, VARIABLE, .5W, 1 KILOHM	5010097-003
R 7	RESISTOR, CARBON, 1/4W, 5%, 1.5 KILOHM	4045000-152
R 8	RESISTOR, CARBON, 1/4W, 5%, 470 OHM	4045000-471
R 9	RESISTOR, WIREWOUND, 1W, 1.5 OHM	5110032-015
R 10	RESISTOR, PRECISION, 1%, 909 OHMS	4710036-031
R 11	RESISTOR, FILM 681 OHM 1%	4710036-018
R 12	RESISTOR, FILM 3.57 K 1%	4710036-039
R 13	RESISTOR, PRECISION, 1%, 562 OHM	4710036-014
R 14	RESISTOR, CARBON, 1/4W, 5%, 120 OHM	4045000-121
R 16	RESISTOR, WIREWOUND, 1W, 1.5 OHM	5110032-015
R 17	RESISTOR, PRECISION, 1%, 1.21K	4710036-001
R 18	RESISTOR, PRECISION, 1%, 562 OHM	4710036-014
R 19	RESISTOR, PRECISION, 1%, 4.75 KILOHM	4710036-006
R 20	RESISTOR, PRECISION, 1%, 562 OHM	4710036-014
R 21	RESISTOR, CARBON, 1/4W, 5%, 680 OHM	4045000-681
R 22	RESISTOR, FILM 3.57 K 1%	4710036-039
R 23	RESISTOR, WIREWOUND, 1W, 1 OHM	5110032-010
R 24	RESISTOR, CARBON, 1/4W, 5%, 680 OHM	4045000-681
R 25	RESISTOR, PRECISION, 1%, 1.21K	4710036-001

Table 4-7. Replacement Parts, Power Supply (Dwg. D8454210D) (Cont.)

CIRCUIT REF.	DESCRIPTION	COHU PART NO.
R 26	RESISTOR WIRE WOUND 22K	5110019-223
R 27	RESISTOR, CARBON, 1/4W, 5%, 3.3 MEGOHM	4045000-335
R 28	RESISTOR, CARBON, 1/4W, 5%, 3.3 MEGOHM	4045000-335
R 29	RESISTOR, CARBON, 1/4W, 5%, 33 KILOHM	4045000-333
R 30	RESISTOR, VARIABLE, 1/2W, 100K 20%	5010120-104
R 31	RESISTOR, VARIABLE, 1/2W, 1M 20%	5010120-105
R 32	RESISTOR, CARBON, 1/4W, 5%, 470 KILOHM	4045000-474
R 33	RESISTOR, CARBON, 1/4W, 5%, 330 KILOHM	4045000-334
R 34	RESISTOR, WIREWOUND, 1W, 1 OHM	5110032-010
R 35	RESISTOR, WIREWOUND, 1W, 1.5 OHM	5110032-015
TP 1	CONNECTOR	1710250-001
TP 2	CONNECTOR	1710250-001
TP 3	CONNECTOR	1710250-001
TP 4	CONNECTOR	1710250-001
TP 5	CONNECTOR	1710250-001
TP 6	CONNECTOR	1710250-001
TP 7	CONNECTOR	1710250-001
U 1	INTEGRATED CIRCUIT VOLTAGE REG, U6A7723393	3610071-003
U 2	INTEGRATED CIRCUIT VOLTAGE REG, U6A7723393	3610071-003
U 3	INTEGRATED CIRCUIT VOLTAGE REG, U6A7723393	3610071-003
U 4	INTEGRATED CIRCUIT VOLTAGE REG, U6A7723393	3610071-003
***CR 8	DIODE, RECTIFIER, TYPE 1N5378B	3510036-053
***CR 9	DIODE, RECTIFIER, TYPE 1N5378B	3510036-053
***CR 10	DIODE, RECTIFIER, TYPE 1N5378B	3510036-053
***CR 11	DIODE, RECTIFIER, TYPE 1N5378B	3510036-053
***R 36	RESISTOR, CARBON, 1/2W, 5%, 1 KILOHM	0310030-102
***R 37	RESISTOR, CARBON, 1/4W, 5%, 220 OHM	4050000-221
*S/N 2-0191 AND ON ONLY **S/N 2-0001 THROUGH 2-0280 ONLY ***S/N 2-0281 AND ON ONLY ****S/N 2-0356 AND ON ONLY		

Table 4-8a. Optional Shading Board Replacement Parts (S/N 5-0001 through 5-0005)

CIRCUIT REF.	DESCRIPTION	COHU PART NO.
C 1	CAPACITOR, TANTALUM, 150UF, 15V	0510155-001
C 2	CAPACITOR, METALIZED, 1 UF, 5%, 50V	0610152-003
C 5	CAPACITOR, METALIZED, 1 UF, 5%, 50V	0610152-003
C 6	CAPACITOR, CERAMIC DISC, .001UF, 500V	0401046
C 7	CAPACITOR, FILM, .10UF, 100V	0610136-104
C 10	CAPACITOR, CERAMIC .005 UF, 50V	0410009-502
C 13	CAPACITOR, FILM, .10UF, 100V	0610136-104
C 14	CAPACITOR, SILVERED MICA, 3300PF, 500WVDC	1010007-332
C 17	CAPACITOR, SILVERED MICA, 3300PF, 500WVDC	1010007-332
C 20	CAPACITOR, CERAMIC DISC, .001UF, 500V	0401046
C 23	CAPACITOR, CERAMIC DISC, 0.1UF, 20V	0410036-002
C 26	CAPACITOR, TANTALUM, 150UF, 15V	0510155-001
C 27	CAPACITOR, CERAMIC DISC, .001UF, 500V	0401046
C 29	CAPACITOR, TANTALUM, 150UF, 15V	0510155-001
C 30	CAPACITOR, CERAMIC DISC, .001UF, 500V	0401046
C 32	CAPACITOR, FILM, .10UF, 100V	0610136-104
CR 1	DIODE, ZENER, TYPE 1N956A	3510047-009
CR 2	DIODE, ZENER, TYPE 1N957B	3510036-018
Q 1	TRANSISTOR, TYPE 2N4124	7210072-002
Q 2	TRANSISTOR, TYPE 2N4124	7210072-002
Q 3	TRANSISTOR, TYPE 2N4126	7210072-003
R 1	RESISTOR, CARBON, 1/4W, 5%, 3.3 KILOHM	4010025-332
R 2	RESISTOR, CARBON, 1/4W, 5%, 4.7 KILOHM	4010025-472
R 5	RESISTOR, CARBON, 1/4W, 5%, 4.7 KILOHM	4010025-472
R 6	RESISTOR, CARBON, 1/4W, 5%, 3.9 KILOHM	4010025-392
R 7	RESISTOR, CARBON, 1/4W, 5%, 47 KILOHMS	4010025-473
R 8	RESISTOR, VARIABLE, 1/2W, 1K, 20%	5010120-102
R 11	RESISTOR, CARBON, 1/4W, 5%, 4.7 KILOHM	4010025-472
R 12	RESISTOR, CARBON, 1/4W, 5%, 3.9 KILOHM	4010025-392
R 13	RESISTOR, CARBON, 1/4W, 5%, 47 KILOHMS	4010025-473
R 14	RESISTOR, VARIABLE, 1/2W, 1K, 20%	5010120-102
R 17	RESISTOR, VARIABLE, 1/2W, 10K 20%	5010120-103
R 19	RESISTOR, CARBON, 1/4W, 5%, 4.7 KILOHM	4010025-472
R 20	RESISTOR, CARBON, 1/4W, 5%, 12 KILOHMS	4010025-123
R 21	RESISTOR, CARBON, 1/4W, 5%, 5.6 KILOHM	4010025-562
R 22	RESISTOR, CARBON, 1/4W, 5%, 5.6 KILOHM	4010025-562
R 23	RESISTOR, CARBON, 1/4W, 5%, 1.5 KILOHM	4010025-152
R 24	RESISTOR, CARBON, 1/4W, 5%, 4.7 KILOHM	4010025-472
R 25	RESISTOR, CARBON, 1/4W, 5%, 1.2 KILOHMS	4010025-122
R 26	RESISTOR, CARBON, 1/4W, 5%, 10 KILOHM	4010025-103
R 27	RESISTOR, CARBON, 1/4W, 5%, 220 OHM	4010025-221
R 30	RESISTOR, CARBON, 1/4W, 5%, 470 OHM	4010025-471
R 31	RESISTOR, CARBON, 1/4W, 5%, 1 KILOHM	4010025-102
R 34	RESISTOR, CARBON, 1/4W, 5%, 22 KILOHM	4010025-223
R 35	RESISTOR, CARBON, 1/4W, 5%, 4.7 KILOHM	4010025-472
R 38	RESISTOR, CARBON, 1/4W, 5%, 4.7 KILOHM	4010025-472
R 39	RESISTOR, CARBON, 1/4W, 5%, 3.9 KILOHM	4010025-392
R 40	RESISTOR, CARBON, 1/4W, 5%, 47 KILOHMS	4010025-473
R 41	RESISTOR, VARIABLE, 1/2W, 1K, 20%	5010120-102
R 44	RESISTOR, CARBON, 1/4W, 5%, 4.7 KILOHM	4010025-472

Table 4-8a. Optional Shading Board Replacement Parts (S/N 5-0001 through 5-0005) (Cont.)

CIRCUIT REF.	DESCRIPTION	COHU PART NO.
R 45	RESISTOR, CARBON, 1/4W, 5%, 3.9 KILOHM	4010025-392
R 46	RESISTOR, CARBON, 1/4W, 5%, 47 KILOHMS	4010025-473
R 47	RESISTOR, VARIABLE, 1/2W, 1K, 20%	5010120-102
R 50	RESISTOR, CARBON, 1/4W, 5%, 1.8 KILOHM	4010025-182
R 51	RESISTOR, CARBON, 1/4W, 5%, 5.6 KILOHM	4010025-562
R 52	RESISTOR, CARBON, 1/4W, 5%, 12 KILOHMS	4010025-123
R 53	RESISTOR, CARBON, 1/4W, 5%, 1.5 KILOHM	4010025-152
R 54	RESISTOR, CARBON, 1/4W, 5%, 5.6 KILOHM	4010025-562
R 55	RESISTOR, CARBON, 1/4W, 5%, 220 OHM	4010025-221
R 56	RESISTOR, CARBON, 1/4W, 5%, 10 KILOHM	4010025-103
R 59	RESISTOR, VARIABLE, 1/2W, 100K 20%	5010120-104
R 60	RESISTOR, CARBON, 1/4W, 5%, 10 KILOHM	4010025-103
R 63	RESISTOR, CARBON, 1/4W, 5%, 56 OHMS	4010025-560
R 65	RESISTOR, CARBON, 1/4W, 5%, 56 OHMS	4010025-560
R 66	RESISTOR, CARBON, 1/4W, 5%, 120 OHMS	4010025-121
U 1	INTEGRATED CIRCUIT, N5558V	3610132-001
U 2	INTEGRATED CIRCUIT, SN 72702N	3610133-001
U 3	INTEGRATED CIRCUIT, N5558V	3610132-001
U 4	INTEGRATED CIRCUIT, SN 72702N	3610133-001

Table 4-8b. Replacement Parts, Optional Shading Board (S/ N 5-0006 and ON)

CIRCUIT REF.		DESCRIPTION	COHU PART NO.
C	1	CAPACITOR, TANTALUM, 20% 150UF, 15V	0510155-001
C	2	CAPACITOR, METALIZED, 5%, 1UF, 50V	0610152-003
C	5	CAPACITOR, METALIZED, 5%, 1UF, 50V	0610152-003
C	6	CAPACITOR, SILVER MICA, 500PF, 500V	1010006-501
C	7	CAPACITOR, TANTALUM, 20%, 10UF, 35V	0510155-008
C	10	CAPACITOR, CERAMIC DISC, .001UF, 500V	0401046
C	13	CAPACITOR, TANTALUM, 20%, 1UF, 35V	0510155-004
C	14	CAPACITOR, SILVERED MICA, 3300PF, 500WVDC	1010007-332
C	17	CAPACITOR, SILVERED MICA, 3300PF, 500WVDC	1010007-332
C	20	CAPACITOR, SILVER MICA, 500PF, 500V	1010006-501
C	23	CAPACITOR, CERAMIC DISC, 20%, .1UF, 20V	0410036-002
C	24	CAPACITOR, CERAMIC DISC, 20%, .1UF, 20V	0410036-002
C	26	CAPACITOR, ELECTROLYTIC, 150UF, 150V	0510156-157
C	27	CAPACITOR, CERAMIC DISC, .001UF, 500V	0401046
C	29	CAPACITOR, ELECTROLYTIC, 150UF, 150V	0510156-157
C	30	CAPACITOR, CERAMIC DISC, .001UF, 500V	0401046
C	33	CAPACITOR, FILM, 0.01MFD, 100V	0610136-103
CR	3	DIODE, ZENER, 8.2V, IN5237A	3510036-055
CR	4	DIODE, ZENER, 8.2V, IN5237A	3510036-055
Q	1	TRANSISTOR, TYPE 2N4126	7210072-003
Q	2	TRANSISTOR, TYPE 2N4126	7210072-003
Q	3	TRANSISTOR, TYPE 2N4124	7210072-002
R	2	RESISTOR, CARBON, 1/4W, 5% 1 KILOHM	4010025-102
R	5	RESISTOR, CARBON, 1/4W, 5% 1 KILOHM	4010025-102
R	6	RESISTOR, CARBON, 1/4W, 5% 1 KILOHM	4010025-102
R	7	RESISTOR, CARBON, 1/4W, 5%, 47 KILOHM	4010025-473
R	8	RESISTOR, VARIABLE, 1/2W, 1K, 20%	5010120-102
R	11	RESISTOR, CARBON, 1/4W, 5% 1 KILOHM	4010025-102
R	12	RESISTOR, CARBON, 1/4W, 5% 1 KILOHM	4010025-102
R	13	RESISTOR, CARBON, 1/4W, 5%, 47 KILOHM	4010025-473
R	14	RESISTOR, VARIABLE, 1/2W, 1K, 20%	5010120-102
R	17	RESISTOR, VARIABLE, 1/2W, 5K OHM 20%	5010120-502
R	19	RESISTOR, CARBON, 1/4W, 5%, 4.7 KILOHM	4010025-472
R	20	RESISTOR, CARBON, 1/4W, 5%, 4.7 KILOHM	4010025-472
R	21	RESISTOR, CARBON, 1/4W, 5%, 10 KILOHM	4010025-103
R	22	RESISTOR, CARBON, 1/4W, 5%, 4.7 KILOHM	4010025-472
R	23	RESISTOR, CARBON, 1/4W, 5%, 6.8 KILOHM	4010025-682
R	24	RESISTOR, CARBON, 1/4W, 5%, 4.7 KILOHM	4010025-472
R	25	RESISTOR, CARBON, 1/4W, 5%, 1.2 KILOHM	4010025-122
R	26	RESISTOR, CARBON, 1/4W, 5%, 10 KILOHM	4010025-103
R	27	RESISTOR, CARBON, 1/4W, 5%, 220 OHM	4010025-221
R	30	RESISTOR, CARBON, 1/4W, 5%, 470 OHM	4010025-471
R	31	RESISTOR, CARBON, 1/4W, 5% 1 KILOHM	4010025-102
R	34	RESISTOR, CARBON, 1/4W, 5%, 22 KILOHM	4010025-223
R	35	RESISTOR, CARBON, 1/4W, 5%, 4.7 KILOHM	4010025-472
R	38	RESISTOR, CARBON, 1/4W, 5% 1 KILOHM	4010025-102
R	39	RESISTOR, CARBON, 1/4W, 5% 1 KILOHM	4010025-102
R	40	RESISTOR, CARBON, 1/4W, 5%, 47 KILOHM	4010025-473
R	41	RESISTOR, VARIABLE, 1/2W, 1K, 20%	5010120-102
R	44	RESISTOR, CARBON, 1/4W, 5% 1 KILOHM	4010025-102
R	45	RESISTOR, CARBON, 1/4W, 5% 1 KILOHM	4010025-102

Table 4-8b. Replacement Parts, Optional Shading Board (S/ N 5-0006 and ON)

CIRCUIT REF.	DESCRIPTION	COHU PART NO.
R 46	RESISTOR, CARBON, 1/4W, 5%, 47 KILOHM	4010025-473
R 47	RESISTOR, VARIABLE, 1/2W, 1K, 20%	5010120-102
R 50	RESISTOR, CARBON, 1/4W, 5%, 1.8 KILOHM	4010025-182
R 51	RESISTOR, CARBON, 1/4W, 5%, 10 KILOHM	4010025-103
R 52	RESISTOR, CARBON, 1/4W, 5%, 4.7 KILOHM	4010025-472
R 53	RESISTOR, CARBON, 1/4W, 5%, 6.8 KILOHM	4010025-682
R 54	RESISTOR, CARBON, 1/4W, 5%, 4.7 KILOHM	4010025-472
R 55	RESISTOR, CARBON, 1/4W, 5%, 220 OHM	4010025-221
R 56	RESISTOR, CARBON, 1/4W, 5%, 10 KILOHM	4010025-103
R 59	RESISTOR, VARIABLE, 1/2W, 100K 20%	5010120-104
R 60	RESISTOR, CARBON, 1/4W, 5%, 10 KILOHM	4010025-103
R 63	RESISTOR, CARBON, 1/4W, 5%, 56 OHM	4010025-560
R 65	RESISTOR, CARBON, 1/4W, 5%, 39 OHM	4010025-390
R 68	RESISTOR, CARBON, 1/4W, 5%, 47 KILOHM	4010025-473
R 69	RESISTOR, CARBON, 1/4W, 5%, 1 KILOHM	4010025-102
R 70	RESISTOR, CARBON, 1/4W, 5%, 47 KILOHM	4010025-473
U 1	INT. CKT, DUAL OPER AMP, TYPE 2N5558	3610132-001
U 2	INT CKT, OPER AMP TYPE SN72702N	3610133-001
U 3	INT. CKT, DUAL OPER AMP, TYPE 2N5558	3610132-001
U 4	INT CKT, OPER AMP TYPE SN72702N	3610133-001

Table 4-9a. Replacement Parts, A1 Bandpass Filter

CIRCUIT REF.	DESCRIPTION	COHU PART NO.
C 1	CAPACITOR, SILVER MICA, 150 PF, 500V	1010006-151
C 1	CAPACITOR, SILVER MICA, 39PF, 500V	1010006-390
C 1	CAPACITOR, SILVER MICA, 68PF, 500V	1010006-680
C 2	CAPACITOR, SILVER MICA, 120PF, 500V	1010006-121
C 2	CAPACITOR, SILVER MICA, 220PF, 500V	1010006-221
C 2	CAPACITOR, SILVER MICA, 560PF, 300V	1010006-561
C 3	CAPACITOR, SILVER MICA, 150 PF, 500V	1010006-151
C 3	CAPACITOR, SILVER MICA, 39PF, 500V	1010006-390
C 3	CAPACITOR, SILVER MICA, 68PF, 500V	1010006-680
L 1	INDUCTOR, 0.47 UH	2310067-004
L 1	INDUCTOR, 1 UH	2310067-008
L 1	INDUCTOR, 2.2 UH	2310067-012
L 2	INDUCTOR, 0.47 UH	2310067-004
L 2	INDUCTOR, 1 UH	2310067-008
L 2	INDUCTOR, 2.2 UH	2310067-012

Table 4-9b. Replacement Parts, Hi Peaker

CIRCUIT REF.	DESCRIPTION	COHU PART NO.
A 1	HI-PEAKER (10MHZ) ASSY	8459701-010
A 1	HI-PEAKER (20MHZ) ASSY	8459701-020
C 1	CAPACITOR, SILVER MICA, 750 PF, 300V	1010006-751
C 2	CAPACITOR, TANTALUM, 20%, 2.2UF, 25V	0510155-002
C 3	CAPACITOR, TANTALUM, 20%, 2.2UF, 25V	0510155-002
Q 1	TRANSISTOR, TYPE 2N4126	7210072-003
R 1	RESISTOR, CARBON, 1/4W, 5%, 75 OHMS	4010025-750
R 2	RESISTOR, CARBON, 1/4W, 5%, 39 OHM	4010025-390
R 3	RESISTOR, VARIABLE, .5W, 1 KILOHM	5010097-003
R 4	RESISTOR, CARBON, 1/4W, 5%, 1.8 KILOHM	4010025-182
R 5	RESISTOR, CARBON, 1/4W, 5%, 2.2 KILOHM	4010025-222
R 6	RESISTOR, CARBON, 1/4W, 5%, 2.2 KILOHM	4010025-222
R 7	RESISTOR, CARBON, 1/4W, 5%, 1.5 KILOHM	4010025-152
*C 11	CAPACITOR, SILVER MICA, 130 PF, 500V	1010006-131
**C 11	CAPACITOR, SILVER MICA, 270 PF, 500V	1010006-271
*L 1	INDUCTOR, VARIABLE, 5.02-6.2 UH	2310056-011
**L 1	INDUCTOR, VARIABLE, 13.9-15.8 UH	2310056-007
*UNIT SERIAL NUMBER 7-0001 AND ON **UNIT SERIAL NUMBER 8-0001 AND ON		

SUPPLEMENT

8459601 DEFLECTION BOARD
DESCRIPTION AND MAINTENANCE5-1. GENERAL DESCRIPTION

The 8459601 Deflection board is a plug-in printed circuit board assembly that is used in 6950 and 7950 Camera Controls designed to operate with a Cohu 2000 Series Camera. It fits in the camera control in the card position otherwise occupied by the 8455801 or 8455901 Deflection board (A2, Figure 4-1) that is described in Section III. Its primary function is to generate horizontal and vertical rate waveforms for driving the deflection coils in the camera and other circuits in both the camera and camera control. It also generates +750 volts dc for use at the camera, and it provides master controls for picture height, width and focus.

5-2. CIRCUIT DESCRIPTION

The circuits on the deflection board are described in Paragraphs 5-4 through 5-9. The descriptions are keyed to the block diagram in Figure 5-1. Also refer to the deflection board schematic at end of section.

5-3. HORIZONTAL DRIVE PULSE AND HORIZONTAL CLAMP PULSE GENERATION

A negative-going composite sync waveform (Figure 1-3, 1-4 or 1-5) received at board terminal 16 from the external or internal system synchronizing signal source first is isolated from the line passing it through isolation resistor R1 and buffer amplifier Q14. The buffered waveform (A and M, Figures 5-2 and 5-3) then is converted to positive-going polarity by inverter U3-11, after which it is made available for external use at board output terminal 5. It also is differentiated by C40 and R40 to develop a positive-going spike (C, Figure 5-2) coincident with the leading edge of each sync pulse in the waveform. This positive spike triggers a one shot formed with NOR gates U4-3 and U4-14. When triggered the one shot supplies a negative pulse at U4-3 and a positive pulse at U4-14 (F and E, Figure 5-2). The durations of these pulses are set with SAW DELAY control R42 so they last approximately 70% of the horizontal line time, thus preventing the one shot from triggering during the equalizing and vertical sync intervals except at the horizontal line rate.

The positive pulse supplied at U4-14 discharges capacitor C42 by turning on transistor Q15. When the pulse ends C42 recharges toward +20 volts through R45. The resulting waveform at C42 is a sawtooth (J, Figure 3-2) with a positive ramp having a peak-to-peak amplitude that is established by the setting of SAW AMPL control R44. At a level set with CABLE DELAY control R46 the positive peaks of this sawtooth waveform drive transistor Q16 to saturation, thereby developing a negative-going pulse (K, Figure 5-2) at the Q16 collector that is advanced from the sync pulse by an amount determined by the setting of R46. From there the pulse is coupled without polarity inversion by emitter follower Q17 to board output terminal 11 where it serves as the horizontal drive output waveform.

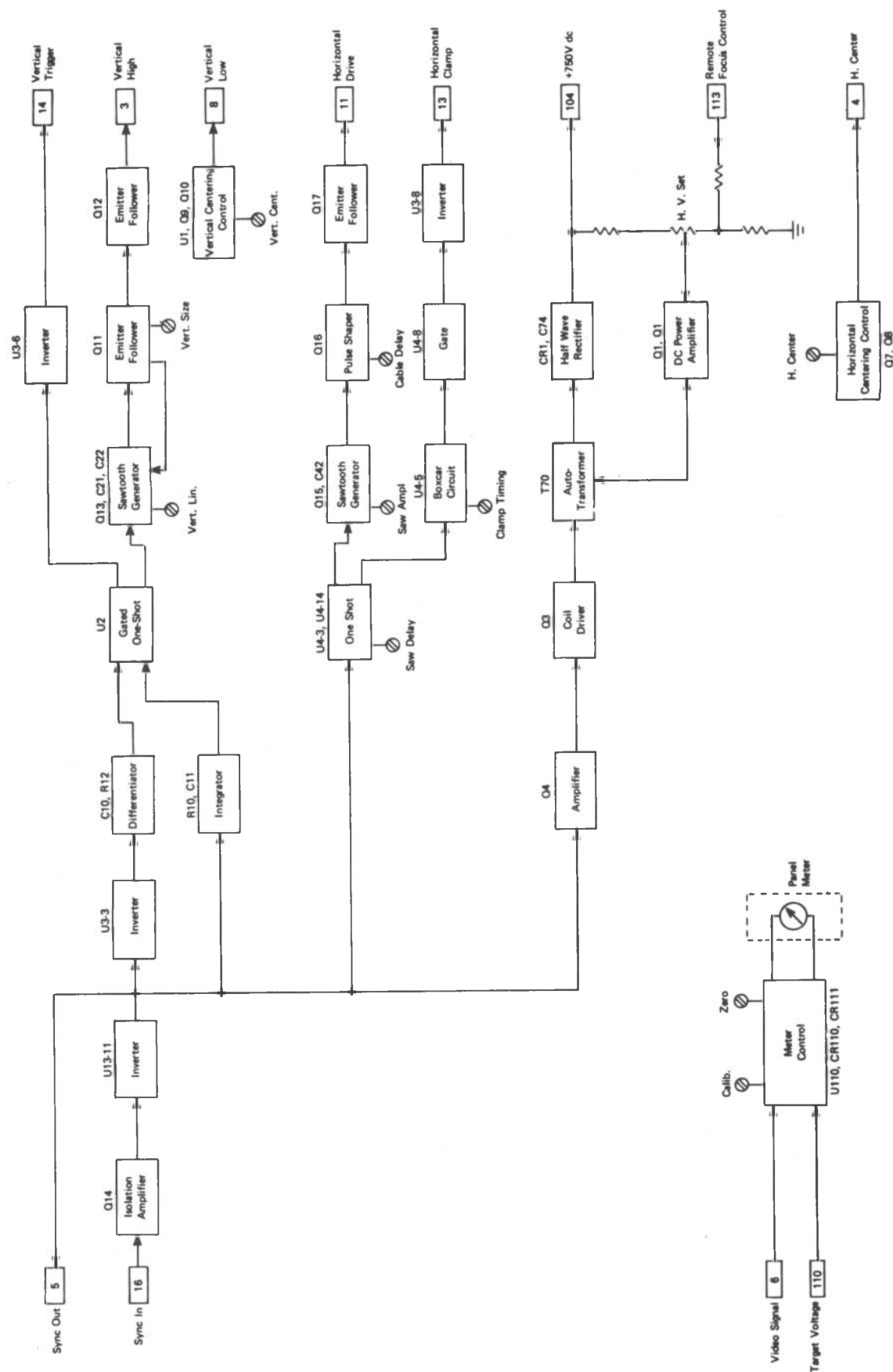
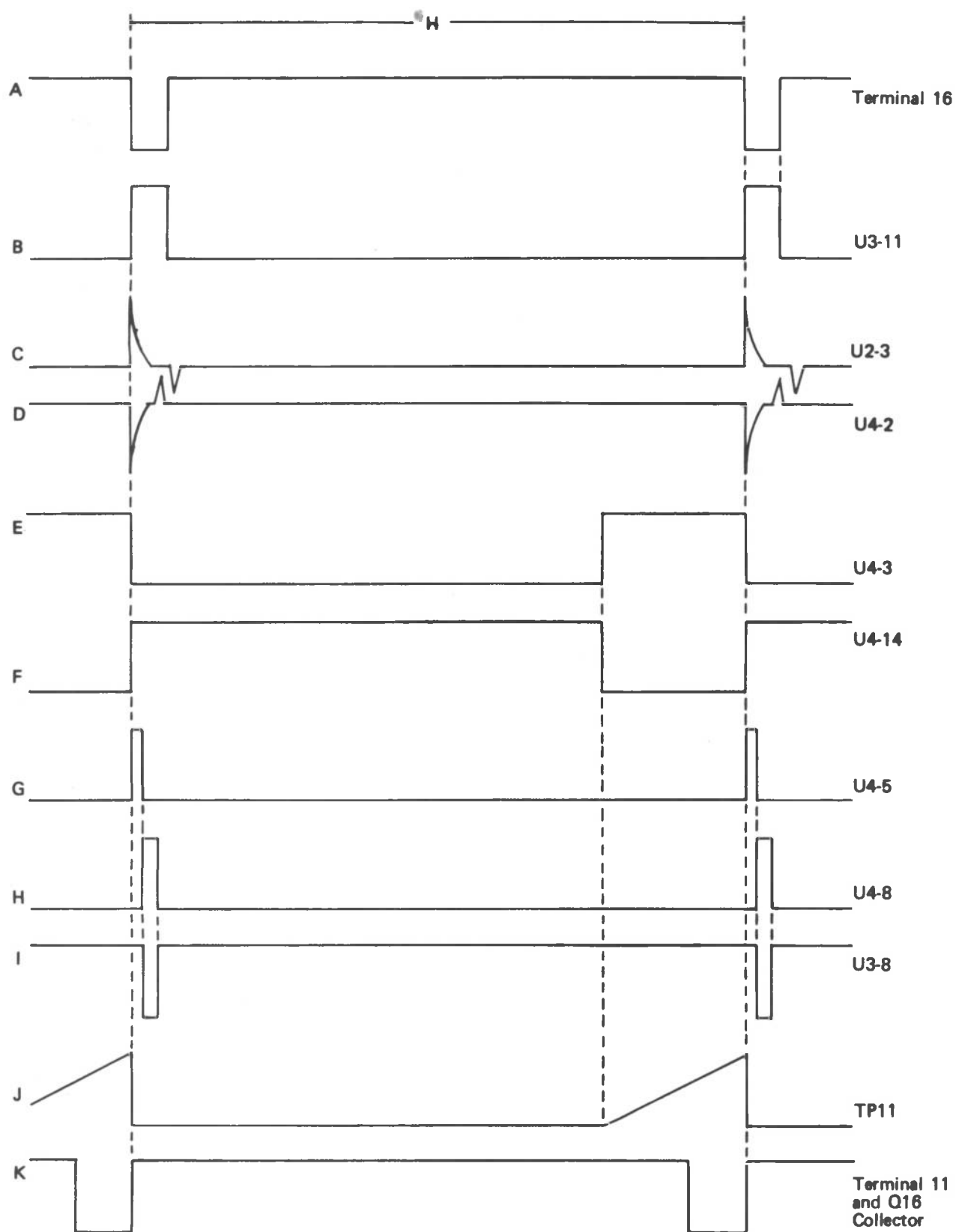


Figure 5-1. Block Diagram, 8459601 Deflection Board Assembly



NOTE: H is time of one horizontal line.

Figure 5-2. Deflection Board 8459601 Waveforms at Active Scan Times

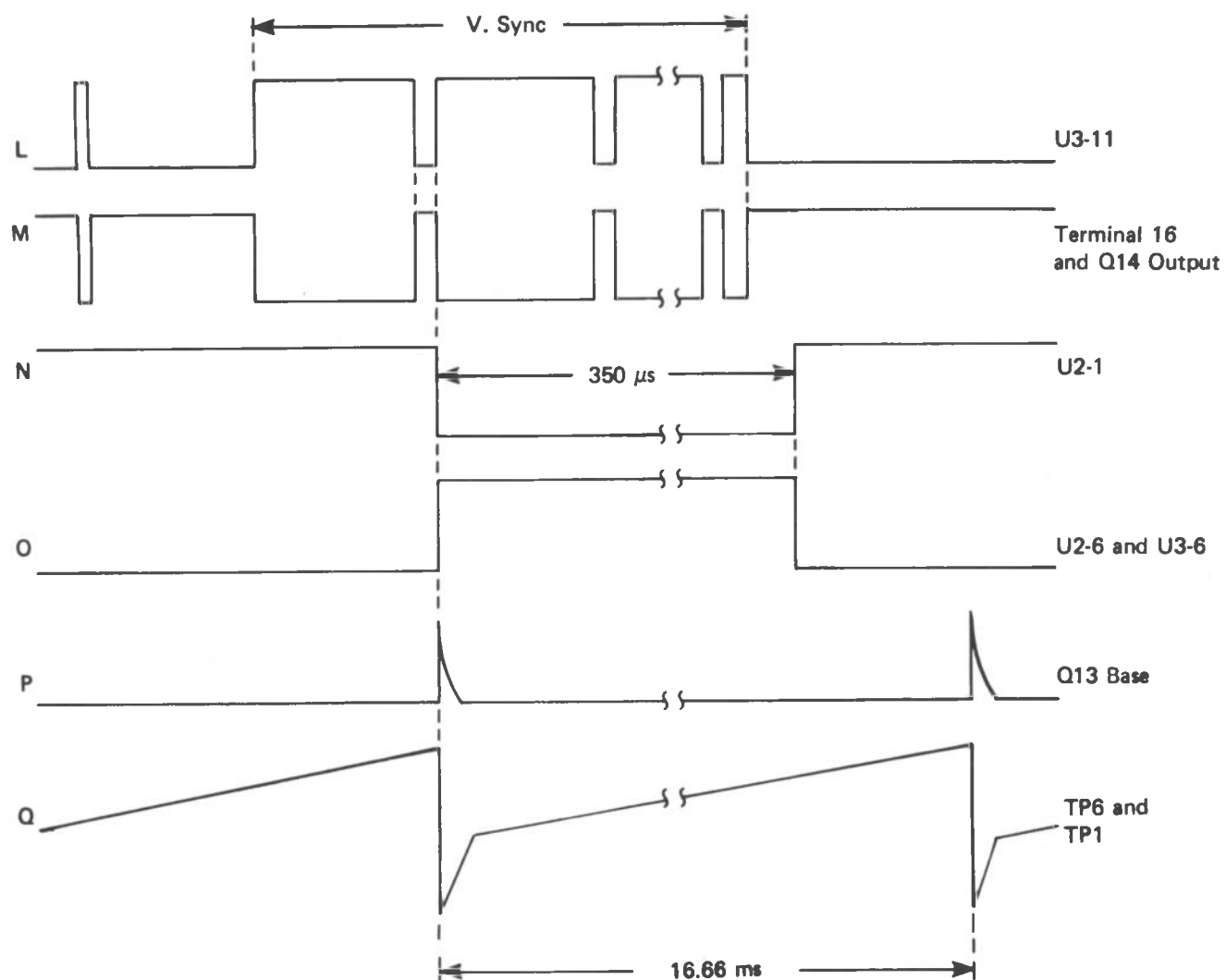


Figure 5-3. Deflection Board 8459601 Waveforms During Vertical Interval

The leading edges of the negative-going pulse (F, Figure 5-2) generated by previously-described one shot U4-3, U4-14 and supplied at terminal U4-3 are used to trigger a boxcar circuit formed with NOR gate U4-5. When triggered, the boxcar circuit supplies at terminal R4-5 a positive-going pulse (G, Figure 5-2), the width of which is set at about 3 microseconds with CLAMP TIMING control R60. The trailing edge of this pulse at U4-5, after differentiation by C61, R62, causes a 2 microsecond positive pulse (H, Figure 5-2) to appear at the output of NOR gate U4-8. An inverter, U3-8, reverses the polarity of the latter to provide a negative-going horizontal clamp pulse (I, Figure 5-2) at board output terminal 13. This horizontal clamp pulse is delayed 3 microseconds with reference to the leading edge of the horizontal sync.

5-4. VERTICAL TRIGGER PULSE GENERATION

The vertical trigger pulse is generated from the positive-going composite sync signal (L, Figure 3-3) at output of inverter U3-11 (Paragraph 5-3). After this sync signal is reversed in polarity by inverter U3-3 it is differentiated by C10, R11 to develop negative-going spikes coincident with the leading edges of the sync pulses. These spikes serve as one of the inputs to a gated one shot in integrated circuit U2. Meanwhile, on another line, the positive-going composite sync signal at U3-11 is applied to an integrator R10, C11. At the first serration in each vertical sync pulse a sufficient positive charge develops on C11 to enable one shot U2 to be triggered with the negative spike at U2-3. The one shot then supplies a negative-going 350 microsecond pulse (N, Figure 3-3) at U2-1 and a positive-going 350 microsecond pulse (O, Figure 3-3) at U2-6. From U2-1 the negative-going pulse is converted to a positive-going pulse (O, Figure 3-6) by inverter U3-6. The latter signal is the vertical trigger pulse that is supplied at board output terminal 14.

5-5. VERTICAL DEFLECTION WAVEFORM GENERATION

At the start of the vertical retrace interval a positive-going 350 microsecond pulse (O, Figure 3-3) appears at output terminal U2-1 of one shot U2. While the pulse is present transistor Q13 is held in the saturation state to discharge capacitors C21 and C22. When the pulse ends Q13 reverts to the cutoff state and C21 and C22 charge through R21 toward +20 volts for about 16 milliseconds. The charging of the two capacitors adds to a step voltage change developed across R23 when Q13 first turns off to produce a trapezoidal waveform with a positive ramp (Q, Figure 3-3). This trapezoidal waveform drives emitter follower stage Q11 whose output is fed back to the junction of C21 and C22 by an amount set with VERT LIN control R25 to linearize the ramp in the sawtooth waveform. The Q11 output also is attenuated by an amount set with VERT SIZE control R26, after which it is coupled by emitter follower Q17 to board output terminal 3. From there it is routed to the camera where it drives the horizontal deflection coil.

5-6. VERTICAL CENTERING CONTROL

The vertical centering control is a 2-stage dc feedback amplifier with an integrated circuit amplifier input stage (U1) and a complementary pair emitter follower output stage (Q9, Q10). The amplifier produces a dc current whose level is set with VERT

CENT control R30. At the camera this dc current is added in the vertical deflection coil to the vertical deflection waveform to provide a dc reference for the latter.

5-7. HORIZONTAL CENTERING CONTROL

The horizontal center control is a complementary pair emitter follower stage (Q7, Q8) that is driven with a dc potential selected with H. CENT control R91. The output of the circuit is a dc potential in the range from -10 volts to +20 volts.

5-8. +750 VOLTS DC GENERATION

A +750 volts dc, approximately, is generated on the deflection board for use in the camera. There it is attenuated and used on grids G3 and G4 of the vidicon. The circuit that generates this +750 volts is formed with transistor stages Q4, Q3, Q2 and Q1.

Transistor Q4 amplifies and reverses the polarity of the horizontal sync pulses in a positive-going composite sync waveform (B, Figure 5-2) to develop negative-going pulses with fast-falling leading edges. Diode CR3 clamps the negative tips of the latter pulses to ground, which adds to the waveform a positive dc level that biases on transistor Q7 between pulses. When the negative-going pulse appears at its base Q7 abruptly turns off, thereby interrupting current flow in auto-transformer T70. The resulting collapse of the magnetic field at T70 generates a high-amplitude positive pulse that is damped on negative excursions by diode CR6 to suppress ringing. The pulse is stepped up by T70 secondary, after which it is half-wave rectified and filtered by diode CR1 and capacitor C74 to provide a smooth +750 volts dc at board output terminal 104. The +750 volt signal that appears at terminal 104 is regulated by comparing it at amplifier Q2 with the regulated +20 volt supply. If the +750 volts deviates from the level preset with H V. SET control R75 an error signal appears at the output of Q2. This error signal restores the +750 volts to normal by changing the bias on Darlington amplifier Q1. The latter supplies the collector voltage for transformer driver Q3.

5-9. METER CONTROL CIRCUIT

Refer to Figure 5-4. Dependent on the setting of the METER switch on the camera control front panel this circuit produces a dc signal that is directly proportional to target voltage on the vidicon at the camera or the peak-to-peak amplitude of video signal at the camera control output. The dc signal thus developed is the one that is used to actuate the VIDEO/TGT meter located on the camera control front panel.

The vidicon target voltage, a variable or adjustable dc potential in the range from zero to approximately +70 volts, enters the deflection board at terminal 110. If the meter is reading target voltage this potential is attenuated by voltage divider R111 and R112 and amplified by operational amplifier U110 to provide a proportional dc potential that appears at U110-6 causes a dc current in the range from zero to one milliamperere to flow in the meter. The maximum current (or full scale reading) is calibrated with CAL control R114, the zero current (or zero scale reading) with ZERO control R116.

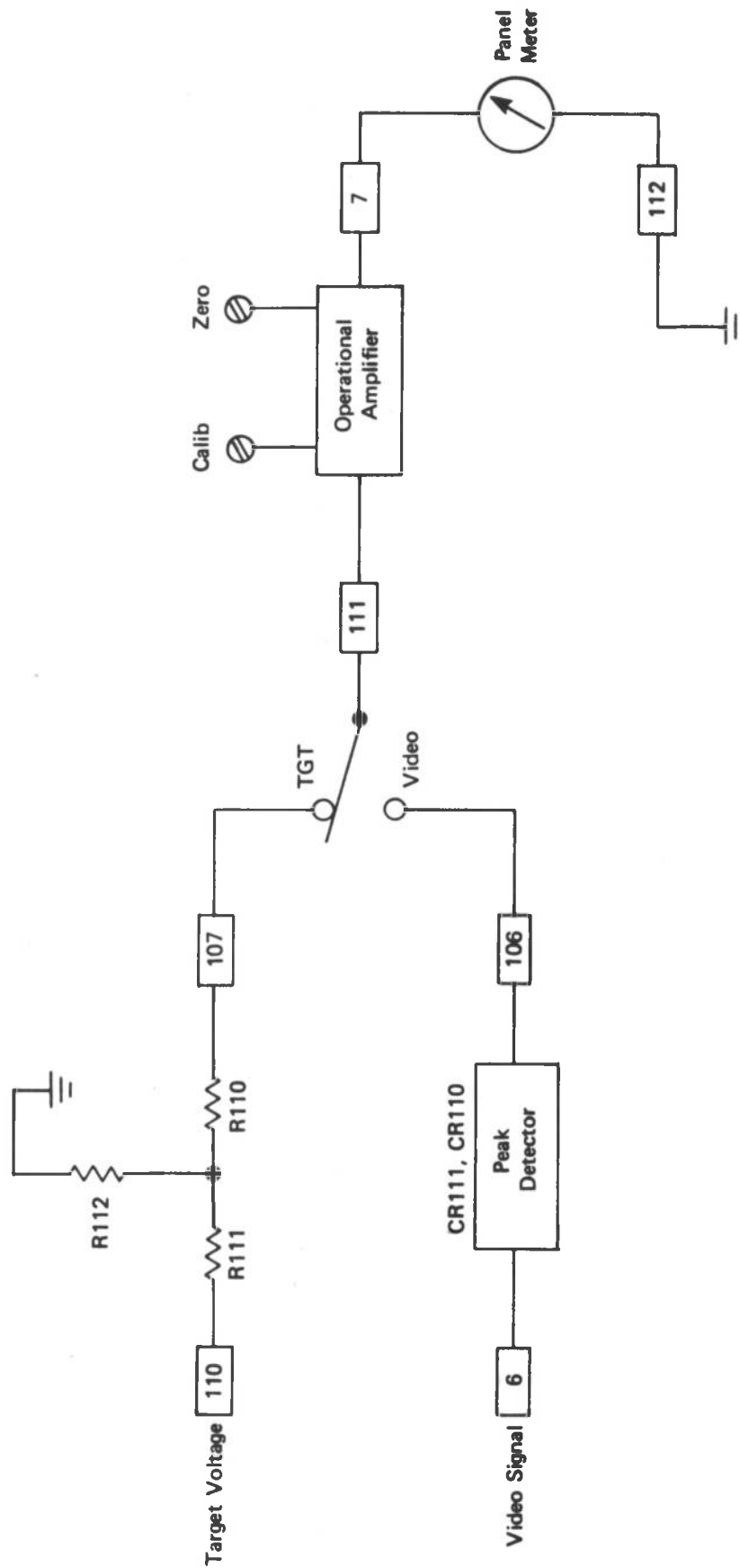


Figure 5-4. Meter Control Circuit

The video signal, a non-composite waveform with a peak-to-peak amplitude in the range from zero to 2 volts, enters the deflection board at terminal 6. If the meter is reading video amplitude the signal is converted into a proportional dc signal by peak detector CR111, CR110, C110. The dc signal then is amplified by operational amplifier U110 to provide a dc voltage in the range from zero to -5 volts at U110-6. The voltage appearing at U110-6 produces the current in the meter and the meter is calibrated in the same way as described above for target voltage measurements.

5-10. MAINTENANCE ADJUSTMENTS

The deflection board has 12 adjustable controls, the functions of which are listed in Table 5-1. To locate these controls use Figure 5-5 as a guide.

5-11. TEST EQUIPMENT REQUIRED FOR MAINTENANCE ADJUSTMENTS

- a. Calibrated, wideband dual-trace laboratory quality oscilloscope with a low-capacity probe (Tektronix 545 with 1A1 Preamplifier and P6008 low-capacity X10 attenuator probe, or equivalent)
- b. Camera test jig equipped with RETMA Linearity Chart (Cohu, or equivalent)

NOTE

The RETMA Linearity Chart at the back of the manual may be used in lieu of the above noted test jig.

- c. Dot-bar generator that provides test pattern for television systems having scan rates from 525 lines/frame through 945 lines/frame (Cohu DBG-2, or equivalent)
- d. TV picture monitor
- e. DC Voltmeter, 3% accuracy, with 100 kilohm/volt input impedance (Simpson 269 VOM, or equivalent)

5-12. ADJUSTMENT PROCEDURE

The procedures are broken down into two categories: meter calibration and deflection adjustments. Both procedures are based on the assumption that the camera control unit containing the deflection board is operating in a closed-circuit system with a Cohu 2000 Series Camera and a TV picture monitor.

Meter Calibration:

- a. At the camera control front panel (Figure 4-1) set PWER switch to ON, MTR switch to TGT, TGT switch to MAN, and turn GAIN control fully CCW;

Table 5-1. Adjustable Controls on 8459501 Deflection Board

CONTROL LABEL	CIRCUIT DESIGNATOR	FUNCTION
HORIZ CENT	R91	Positions scanning pattern horizontally on target at camera
VERT CENT	R30	Positions scanning pattern vertically on target at camera
HORIZ SIZE	R83	Adjusts width of scanning pattern on target at camera
VERT SIZE	R26	Adjusts height of scanning pattern on target at camera
H. V. SET	R75	Adjusts +750 volt dc output of deflection board
SAW AMPL	R44	Sets a reference used in advancing timing of horizontal scan to compensate for video signal transmission delays
CABLE DELAY	R46	Adjusts timing of horizontal scan with reference to leading edge of horizontal sync
CLAMP TIMING	R60	Adjusts timing of horizontal clamp pulse with reference to leading edge of horizontal sync
CAL	R114	Calibrates full-scale reading of VIDEO/ TGT meter on camera control front panel
ZERO	R116	Calibrates zero reading of VIDEO/ TGT meter on camera control front panel
SAW DELAY	R42	Sets a reference used in timing of horizontal drive
VERT LIN	R25	Adjusts linearity of vertical scanning

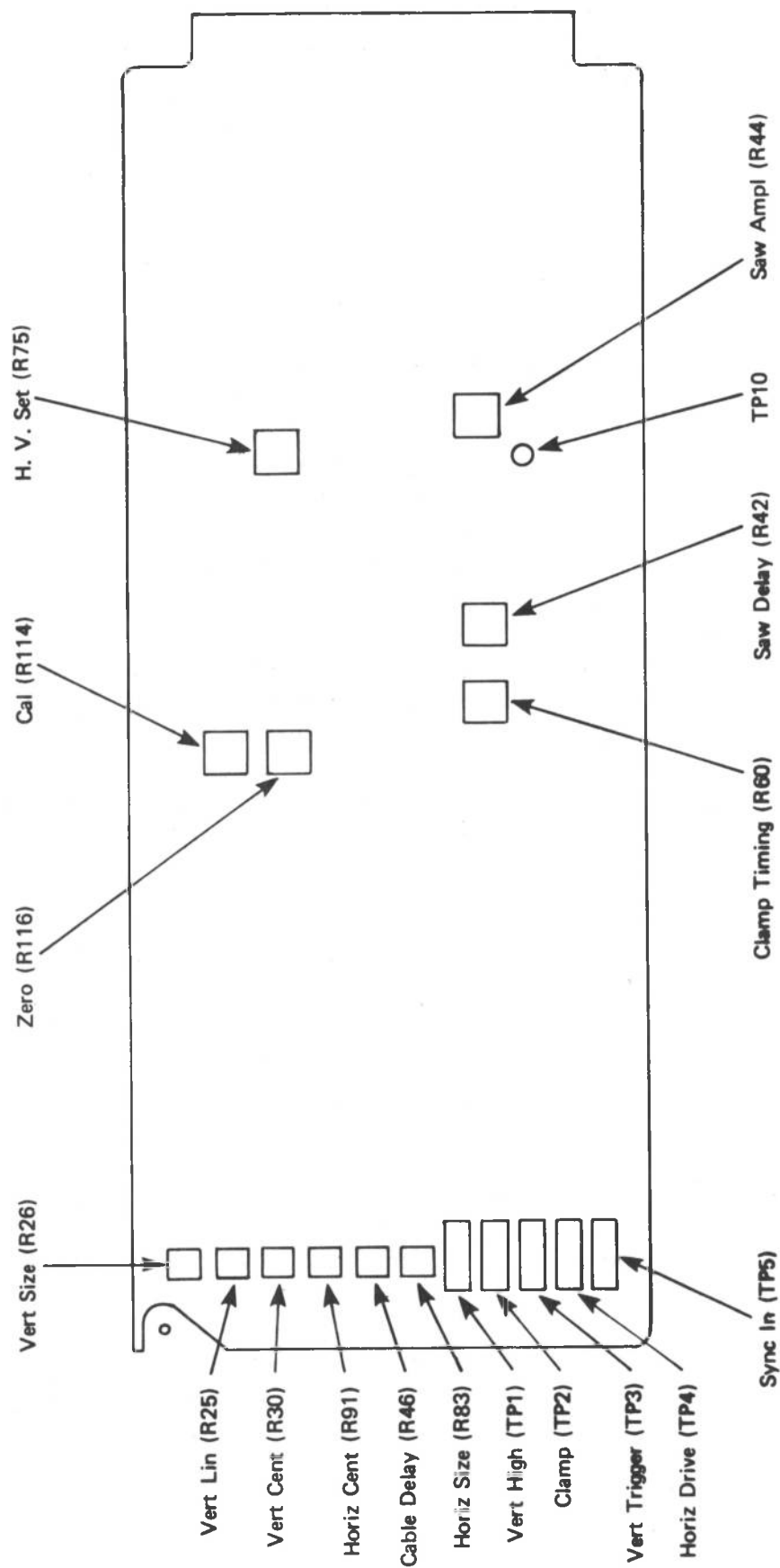


Figure 5-5. Locations of Adjustable Controls and Calibration Test Points

- b. At the deflection board (Figure 5-5) set ZERO control R116 so the meter on the front panel reads zero volts;
- c. Using a dc voltmeter for measurement, adjust the GAIN control on the camera control front panel for a reading of +20 volts at TP7 on the video processor board (Figures 4-1 and 4-5);
- d. Adjust CAL control R114 on the deflection board so the target voltage reading on the front-panel meter coincides with the voltage measurement made at TP7 in step c.

NOTE

The front-panel meter reads 100 volts at full scale for target voltage measurements and is calibrated in 10-volt divisions. For video measurements the meter reads one volt p-p at full scale and is calibrated in divisions of 0.1 volt.

Deflection Adjustments:

- a. Install camera on a Cohu test jig (Type CTF-1) facing a RETMA Linearity Test Chart. If such a test jig is unavailable remove the linearity test chart from back of this manual and hang it on a wall; position the camera so the optical axis of the lens on the camera is perpendicular to and centered on the chart. The proper distance from the plane of the chart to the optical center of the lens depends on focal length of the lens and can be computed with the following formula:

$$\text{Lens-to-chart distance} = \frac{\text{Lens Focal Length} \times \text{Resolution Chart Width} \times 2}{\text{Resolution Chart Height}}$$

where all measurements are in inches

- b. Install the deflection board in the camera control on a board extender; put system into operation and allow at least 15 minutes for warmup;
- c. Set FOCUS control on camera control front panel to the center of its range; adjust H. V. SET control R75 on the deflection board for +750 volts dc output at board terminal 104;
- d. Set SAW DELAY control R42 (Figure 5-5) so the leading edge of the first negative pulse occurring during the vertical sync interval at TP10 lags the trailing edge of the first serration in vertical sync in composite sync signal at TP5 by 2 microseconds, as in Figure 5-6;
- e. Set SAW AMPL control R44 so the peak-to-peak amplitude of the sawtooth waveform at TP11 is 1.5 volts;
- f. Set CABLE DELAY control R46 so horizontal retrace in video signal at TP2 on front end of video processor board (Figure 4-5) starts just after the leading edge of horizontal blanking in composite blanking signal at either BLANK IN or BLANK OUT connector on camera control rear panel (Figure 4-4);

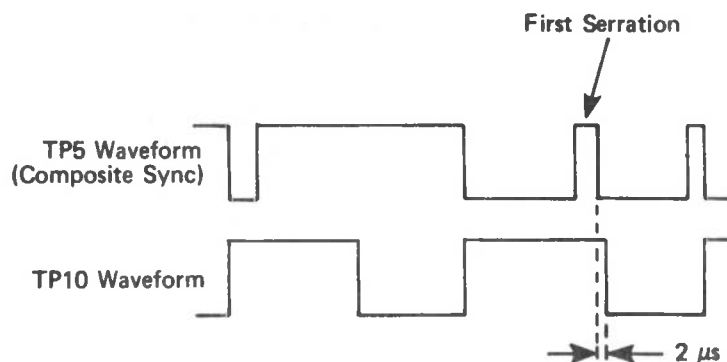


Figure 5-6. Correcting Timing of Waveform at TP10

- g. Set CLAMP TIMING control R60 for minimum horizontal white streaking in picture at TV monitor; if this adjustment does not completely eliminate all white streaks then try readjusting CABLE DELAY control R46;
- h. Install a dot-bar generator (Cohu DBG-2, or equivalent) in the video line going to the TV picture monitor; adjust the controls on the dot-bar generator so 14 rows and 17 columns of dots are displayed on the monitor raster; accurately center the dot pattern on the monitor raster with controls at the dot-bar generator;
- i. Using the H. SIZE, VERT SIZE, VERT LIN, VERT CENT AND H. CENT controls (R83, R26, R25, R30 and R91, Figure 5-5), frame the linearity test pattern on monitor raster so the points of the arrows along the edges of the test pattern just touch or slightly overlap the edges of the raster, and so all dots in the test pattern are inside their corresponding circles on the linearity chart; if all dots can be positioned in their respective circles the camera scan linearity is within $\pm 1\%$; if any of the dots touch the annulus of a circle the scan linearity is within 2% ; if any of the dots is outside its circle the linearity is $\pm 3\%$ or greater.

5-13. WAVEFORMS

Waveforms that should be present at certain points on the deflection board are shown in Figure 5-7.

5-14. SCHEMATIC

The schematic for the circuits on the 8459601 Deflection board is in Figure 5-8.

5-15. REPLACEMENT PARTS

Replacement parts that can be ordered from Cohu or any of its sales representatives for the 8459601 Deflection assembly are listed in Table 5-2.

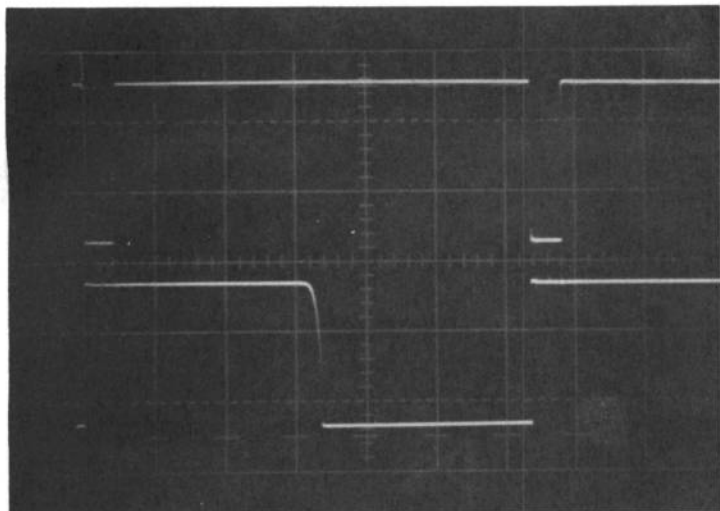
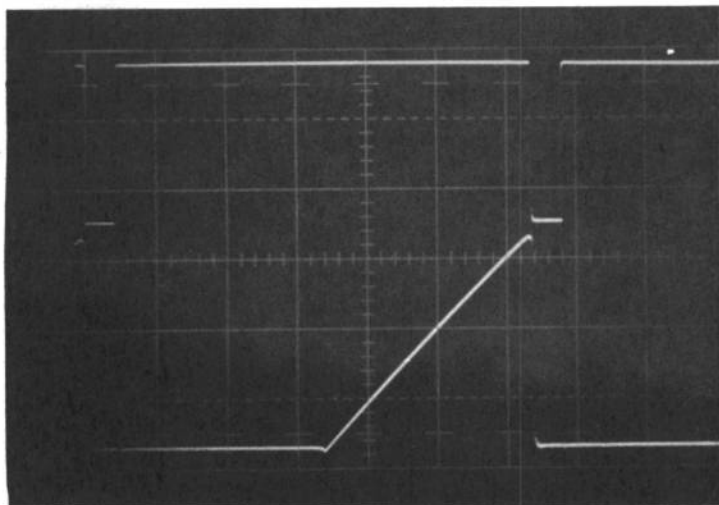
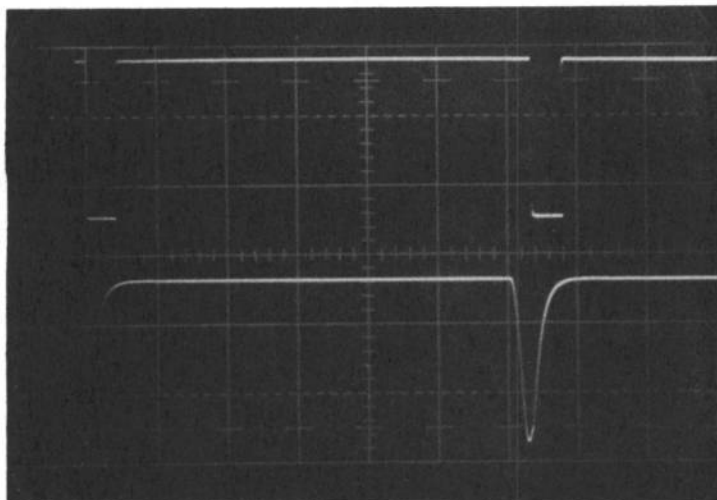
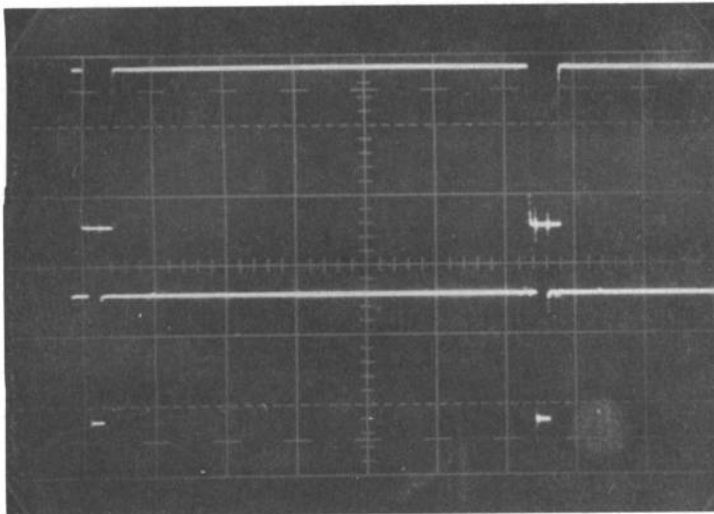
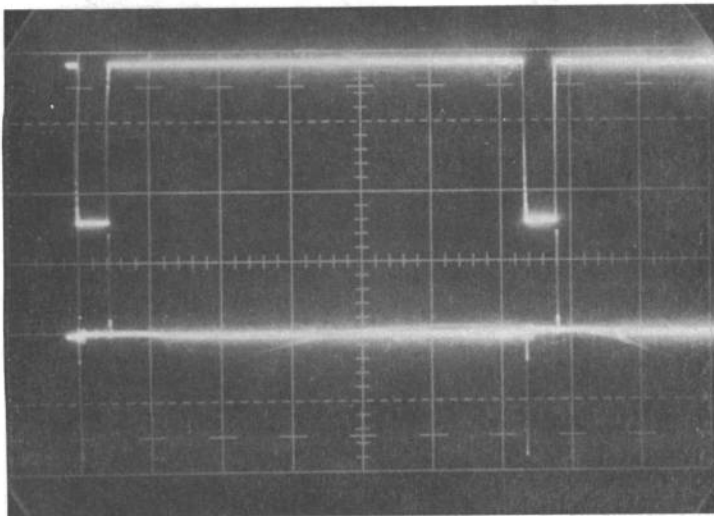
TP5: $10 \mu\text{s}/\text{cm}$; $2\text{V}/\text{cm}$ TP10: $10 \mu\text{s}/\text{cm}$; $1\text{V}/\text{cm}$ TP5: $10 \mu\text{s}/\text{cm}$; $2\text{V}/\text{cm}$ TP11: $10 \mu\text{s}/\text{cm}$; $0.5\text{V}/\text{cm}$ TP5: $10 \mu\text{s}/\text{cm}$; $2\text{V}/\text{cm}$ U4-6: $10 \mu\text{s}/\text{cm}$; $2\text{V}/\text{cm}$

Figure 5-7. Deflection Board 8459601 Waveforms (525-Line Scan Rate)(Sheet 1 of 3)



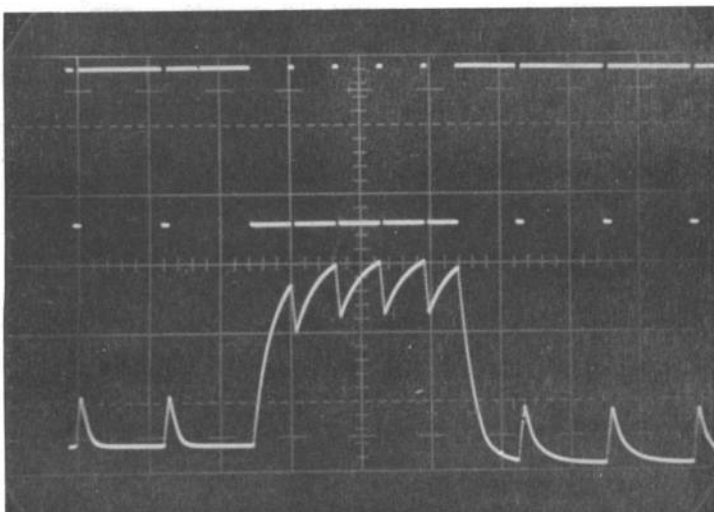
TP5: $10 \mu\text{s}/\text{cm}$; $2\text{V}/\text{cm}$

TP2: $10 \mu\text{s}/\text{cm}$; $2\text{V}/\text{cm}$



TP5: $10 \mu\text{s}/\text{cm}$; $2\text{V}/\text{cm}$

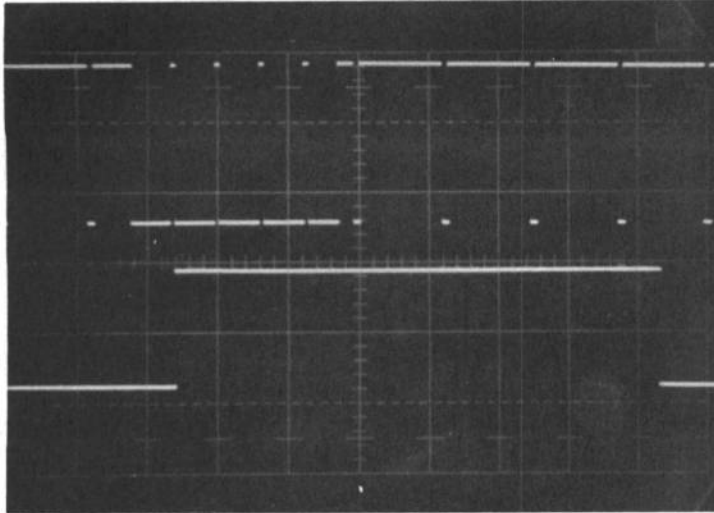
TP9: $10 \mu\text{s}/\text{cm}$; $1\text{V}/\text{cm}$



TP5: $50 \mu\text{s}/\text{cm}$; $2\text{V}/\text{cm}$

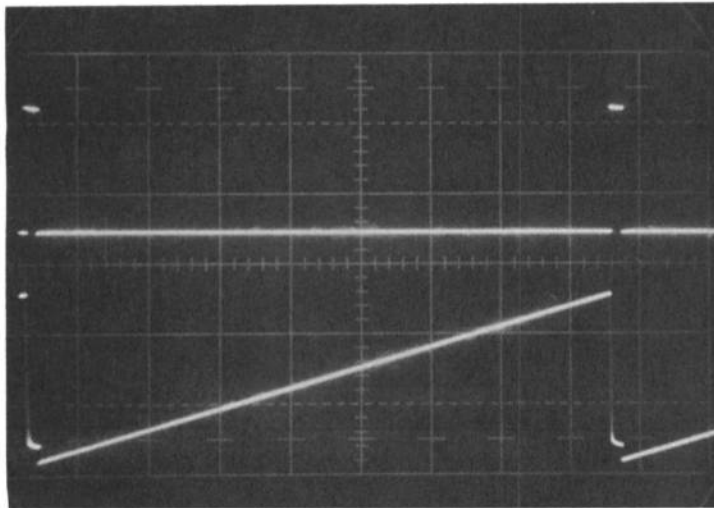
TP8: $5 \mu\text{s}/\text{cm}$; $1\text{V}/\text{cm}$

Figure 5-7. Deflection Board 8459601 Waveforms (525-Line Scan Rate)(Sheet 2 of 3)



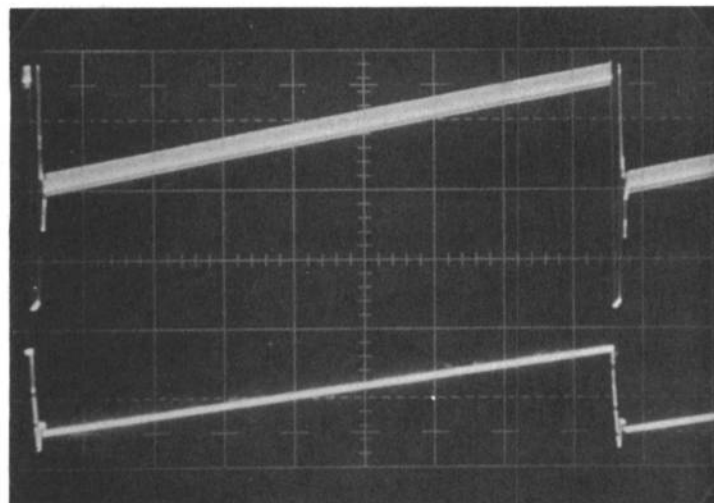
TP5: $50 \mu\text{s}/\text{cm}$; $2\text{V}/\text{cm}$

TP7: $50 \mu\text{s}/\text{cm}$; $2\text{V}/\text{cm}$



TP3: $2 \text{ ms}/\text{cm}$; $2\text{V}/\text{cm}$

TP6: $2 \text{ ms}/\text{cm}$; $1\text{V}/\text{cm}$



TP1: $2 \text{ ms}/\text{cm}$; $5\text{V}/\text{cm}$

Terminal 8: $2 \text{ ms}/\text{cm}$; $2\text{V}/\text{cm}$

Figure 5-7. Deflection Board 8459601 Waveforms (525-Line Scan Rate)(Sheet 3 of 3)

Table 5-2. Replacement Parts, 8459601 Deflection Board

CIRCUIT REF.		DESCRIPTION	COHU PART NO.
C	10	CAPACITOR, SILVER MICA, 68PF, 500V	1010006-680
C	11	CAPACITOR, FILM .033UF 100V	0610136-333
C	12	CAPACITOR, FILM, 0.047MFD, 100V	0610136-473
C	20	CAPACITOR, TANTALUM, 20%, 1UF, 35V	0510155-004
C	21	CAPACITOR, TANTALUM, 2.2UF, 25V	0510155-002
C	22	CAPACITOR, TANTALUM, 2.2UF, 25V	0510155-002
C	40	CAPACITOR, SILVER MICA, 82PF, 500V	1010006-820
C	41	CAPACITOR, FILM, 0.01MFD, 100V	0610136-103
C	42	CAPACITOR, MYLAR, .0033 UF, 400V	0610133-004
C	43	CAPACITOR, FILM, 0.01MFD, 100V	0610136-103
C	44	CAPACITOR, CERAMIC DISC, .001UF, 500V	0401046
C	50	CAPACITOR, FILM .022UF 100V	0610136-223
C	51	CAPACITOR, TANTALUM, 22 UF, 15V	0510155-005
C	60	CAPACITOR, SILVER MICA 330PF 500V	1010006-331
C	61	CAPACITOR, SILVER MICA, 270 PF, 500V	1010006-271
C	70	CAPACITOR, MYLAR, .0033 UF, 400V	0610133-004
C	71	CAPACITOR, MYLAR, 0.47MFD, 100V	0610136-474
C	72	CAPACITOR, FILM, 0.047MFD, 100V	0610136-473
C	73	CAPACITOR, ELECTROLYTIC, 25UF, 25V	0510147-036
C	74	CAPACITOR, LINE BY-PASS, .02UF, 1.4KV	0410013-001
C	75	CAPACITOR, FILM, 0.01MFD, 100V	0610136-103
C	80	CAPACITOR, ELECTROLYTIC, 25UF, 25V	0510147-036
C	90	CAPACITOR, ELECTROLYTIC, 25UF, 25V	0510147-036
C	100	CAPACITOR ELECTROLYTIC 50UF 25V	0510147-043
C	101	CAPACITOR ELECTROLYTIC 50UF 25V	0510147-043
C	102	CAPACITOR ELECTROLYTIC 50UF 25V	0510147-043
C	110	CAPACITOR, FILM, 0.22MFD, 100V	0610136-224
C	111	CAPACITOR, FILM, .10UF, 100V	0610136-104
C	112	CAPACITOR, FILM .022UF 100V	0610136-223
CR	1	DIODE, TYPE SFM 30	3510076-004
CR	2	DIODE, 1N4004	3510018-015
CR	3	DIODE, SILICON, TYPE 1N457	3510042-022
CR	110	DIODE SWITCH TYPE 1N4148	3510042-029
CR	111	DIODE SWITCH TYPE 1N4148	3510042-029
L	100	COIL, 2.2 UH	2310029-023
Q	1	TRANSISTOR, D40C4	7210103-001
Q	2	TRANSISTOR TYPE 2N5462	7210084-003
Q	3	TRANSISTOR TYPE 2N3440	7210035-049
Q	4	TRANSISTOR, TYPE 2N3053	7210035-028
Q	5	TRANSISTOR, TYPE 2N4126	7210072-003
Q	6	TRANSISTOR, TYPE 2N3053	7210035-028
Q	7	TRANSISTOR, TYPE 2N3053	7210035-028
Q	8	TRANSISTOR, TYPE 2N4037	7210035-040
Q	9	TRANSISTOR, TYPE 2N4124	7210072-002
Q	10	TRANSISTOR, TYPE 2N4126	7210072-003
Q	11	TRANSISTOR, TYPE 2N4124	7210072-002
Q	12	TRANSISTOR, TYPE 2N4037	7210035-040
Q	13	TRANSISTOR, TYPE 2N4124	7210072-002
Q	14	TRANSISTOR TYPE 2N5486	7210084-002
Q	15	TRANSISTOR, TYPE 2N4124	7210072-002
Q	16	TRANSISTOR, TYPE 2N4124	7210072-002
Q	17	TRANSISTOR, TYPE 2N3638	7210069-001

Table 5-2. Replacement Parts, 8459601 Deflection Board (Continued)

CIRCUIT REF.		DESCRIPTION	COHU PART NO.
R	1	RESISTOR, CARBON, 1/4W, 5%, 10 KILOHM	4010025-103
R	2	RESISTOR, CARBON, 1/4W, 5%, 100 KILOHM	4010025-104
R	3	RESISTOR, CARBON, 1/4W, 5%, 3.9 KILOHM	4010025-392
R	10	RESISTOR, CARBON, 1/4W, 5%, 470 OHM	4010025-471
R	11	RESISTOR, CARBON, 1/4W, 5%, 330 OHM	4010025-331
R	12	RESISTOR, CARBON, 1/4W, 5% 1 KILOHM	4010025-102
R	13	RESISTOR, CARBON, 1/4W, 5%, 5.60 KILOHM	4010025-562
R	14	RESISTOR, CARBON, 1/4W, 5%, 1.5 KILOHM	4010025-152
R	20	RESISTOR, CARBON, 1/4W, 5%, 22 KILOHM	4010025-223
R	21	RESISTOR, CARBON, 1/4W, 5%, 27 KILOHM	4010025-273
R	22	RESISTOR, CARBON, 1/4W, 5%, 68 OHM	4010025-680
R	23	RESISTOR, CARBON, 1/4W, 5%, 180 OHMS	4010025-181
R	24	RESISTOR, CARBON, 1/4W, 5%, 4.3 KILOHM	4010025-432
R	25	RESISTOR, VARIABLE, 1/2W, 2K 20%	5010120-202
R	26	RESISTOR, VARIABLE, 1/2W, 2K 20%	5010120-202
R	27	RESISTOR, CARBON, 1/4W, 5%, 2.2 KILOHM	4010025-222
R	28	RESISTOR, 1 WATT, 5%, 560 OHM	0310031-561
R	29	RESISTOR, CARBON, 1/4W, 5%, 5.60 KILOHM	4010025-562
R	30	RESISTOR, VARIABLE, 1/2W, 2K 20%	5010120-202
R	31	RESISTOR, CARBON, 1/4W, 5%, 2.7 KILOHM	4010025-272
R	32	RESISTOR, CARBON, 1/4W, 5%, 100 OHMS	4010025-101
R	40	RESISTOR, CARBON, 1/4W, 5%, 10 KILOHM	4010025-103
R	41	RESISTOR, CARBON, 1/4W, 5%, 2.2 KILOHM	4010025-222
R	42	POTENTIOMETER, 1/2W, 5 KILOHMS	5010135-502
R	43	RESISTOR, CARBON, 1/4W, 5% 1 KILOHM	4010025-102
R	44	POTENTIOMETER, 1/2W, 50 KILOHMS	5010135-503
R	45	RESISTOR, CARBON, 1/4W, 5%, 56 KILOHM	4010025-563
R	46	RESISTOR, VARIABLE, 1/2W, 100K 20%	5010120-104
R	47	RESISTOR, CARBON, 1/4W, 5%, 180 KILOHM	4010025-184
R	48	RESISTOR, CARBON, 1/4W, 5%, 10 KILOHM	4010025-103
R	49	RESISTOR, CARBON, 1/4W, 5%, 10 KILOHM	4010025-103
R	50	RESISTOR, CARBON, 1/4W, 5%, 10 KILOHM	4010025-103
R	51	RESISTOR, CARBON, 1/4W, 5%, 47 OHM	4010025-470
R	52	RESISTOR, CARBON, 1/4W, 5% 1 KILOHM	4010025-102
R	53	RESISTOR, CARBON, 1/4W, 5%, 4.7 MEGOHM	4045000-475
R	60	POTENTIOMETER, 1/2W, 50 KILOHMS	5010135-503
R	61	RESISTOR, CARBON, 1/4W, 5%, 2.2 KILOHM	4010025-222
R	62	RESISTOR, CARBON, 1/4W, 5%, 10 KILOHM	4010025-103
R	70	RESISTOR, CARBON, 1/4W, 5%, 12 KILOHM	4010025-123
R	71	RESISTOR, CARBON, 1/4W, 5% 1 KILOHM	4010025-102
R	72	RESISTOR, CARBON, 1/4W, 5%, 22 KILOHM	4010025-223
R	73	RESISTOR, CARBON, 1/4W, 5% 1 KILOHM	4010025-102
R	74	RESISTOR, COMPOSITION, 1/2W, 5%, 22 MEG OHM	0310032-226
R	75	POTENTIOMETER, 3/4W, 1 MEGOHM	5010135-105
R	76	RESISTOR, CARBON, 1/4W, 5%, 330 KILOHM	4010025-334
R	77	RESISTOR, CARBON, 1/4W, 5%, 220 KILOHM	4010025-224
R	78	RESISTOR, CARBON, 1/4W, 5%, 220 KILOHM	4010025-224
R	80	RESISTOR, 1/2 WATT, 5%, 100 OHM	0310030-101
R	81	RESISTOR, CARBON, 1/4W, 5% 1 KILOHM	4010025-102
R	82	RESISTOR, CARBON, 1/4W, 5%, 5.60 KILOHM	4010025-562
R	83	RESISTOR, VARIABLE, 1/2W, 2K 20%	5010120-202
R	84	RESISTOR, CARBON, 1/4W, 5%, 1.2 KILOHM	4010025-122

Table 5-2. Replacement Parts, 8459601 Deflection Board (Continued)

CIRCUIT REF.	DESCRIPTION	COHU PART NO.
R 90	RESISTOR, CARBON, 1/4W, 5%, 1.2 KILOHM	4010025-122
R 91	RESISTOR, VARIABLE, 1/2W, 2K 20%	5010120-202
R 92	RESISTOR, CARBON, 1/4W, 5%, 1 KILOHM	4010025-102
R 93	RESISTOR, 1 WATT, 5%, 180 OHM	0310031-181
R 110	RESISTOR, CARBON, 1/4W, 5%, 22 MEGOHM	4045000-226
R 111	RESISTOR, CARBON, 1/4W, 5%, 22 MEGOHM	4045000-226
R 112	RESISTOR, CARBON, 1/4W, 5%, 22 MEGOHM	4045000-226
R 113	RESISTOR, CARBON, 1/4W, 5%, 1.0 MEGOHM	4045000-105
R 114	POTENTIOMETER, 1/2W, 5 KILOHMS	5010135-502
R 115	RESISTOR, CARBON, 1/4W, 5%, 3.3 MEGOHM	4045000-335
R 116	POTENTIOMETER, 1/2W, 10 KILOHM	5010135-103
R 117	RESISTOR, CARBON, 1/4W, 5%, 100 KILOHM	4010025-104
R 118	RESISTOR, CARBON, 1/4W, 5%, 100 KILOHM	4010025-003
T 70	TRANSFORMER, AUTO	8451522-001
U 1	INT CKT, AMPLIFIER, SN72741P	3610108-001
U 2	INT CKT, SN-74121N, MULTIVIBRATOR	3610090-001
U 3	INT CKT, QUAD 2-INPUT GATE, SN7400N	3610084-001
U 4	INT CKT, QUAD 2-INPUT GATE, MC824P	3610015-001
U 110	INT CKT, AMPLIFIER, SN72741P	3610108-001
	*FOR UNITS WITH SERIAL NUMBER 6-0036 OR HIGHER CHANGE Q4 TO TYPE MPS-A14	7210095-001



WARRANTY

Cohu, Inc., Electronics Division, warrants equipment manufactured to be free from defects of material and workmanship. Any part or parts will be repaired or replaced when proven by COHU examination to have been defective within one year from date of shipment to the original purchaser. All warranty repairs will be performed at the factory or as otherwise authorized by COHU in writing. Transportation charges shall be prepaid by purchaser.

This warranty does not extend to COHU equipment subjected to misuse, accident, neglect or improper application, nor repaired or altered by other than COHU or those authorized by COHU in writing. Television image pickup tubes are warranted by the original manufacturer.

This warranty is in lieu of all other warranties express or implied. COHU shall not be liable for collateral or consequential damages.

For customer convenience, service departments are maintained throughout the United States by COHU Field Engineering Representatives.



5725 Kearny Villa Rd. San Diego, CA 92123 Phone (714) 277-6700 TWX 910-335-1244